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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 1094
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 1096
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 1097
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 1099
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 1100
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION N.A.
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL N.A.

Note: N.A. means that no abstracts were assigned to this category for this issue.

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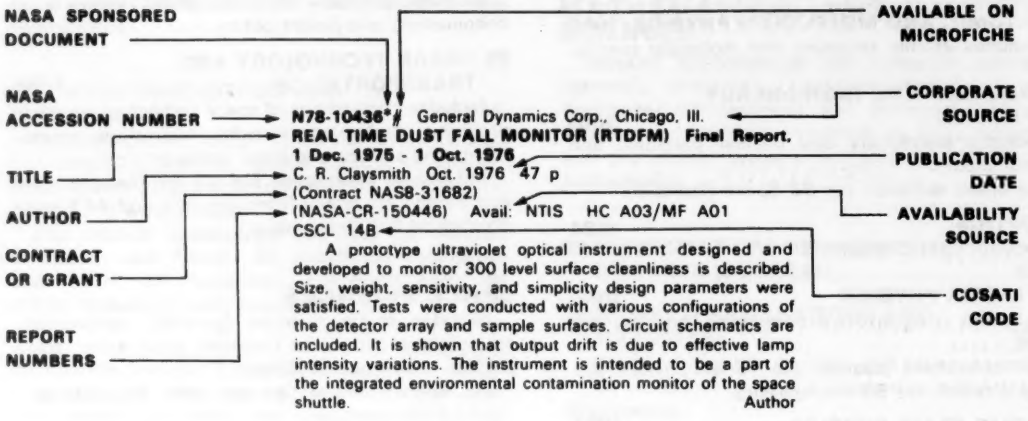
TYPICAL CITATION AND ABSTRACT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REPORT NUMBERS
A prototype ultraviolet optical instrument designed and developed to monitor 300 level surface cleanliness is described. Size, weight, sensitivity, and simplicity design parameters were satisfied. Tests were conducted with various configurations of the detector array and sample surfaces. Circuit schematics are included. It is shown that output drift is due to effective lamp intensity variations. The instrument is intended to be a part of the integrated environmental contamination monitor of the space shuttle.
Author

ON-GOING RESEARCH PROJECTS

This is a listing of research projects – not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, EVALUATION OF A PRESSURIZED AIR START SYSTEM FOR ADVANCED ARMY HELICOPTERS
J. RHODEN, Signal Companies Incorporated, *Phoenix, Arizona* 85034 (DA0D4098; DAAJ02-77-C-0007)

The pressurized air start system (PASS) concept has been evaluated for starting gas turbine engines that currently use electric starters in conjunction with nickel-cadmium batteries and offers several advantages. The objective of this study is to investigate the concept in further detail prior to an advanced or engineering hardware development program.

Preliminary evaluation has shown that the pressurized air start system (PASS) offers several advantages over current electric start systems used on helicopters. The primary advantages are its inherent low-temperature capability (minus 25F and below), combined with a significant weight reduction to the aircraft. The evaluation to date has been based primarily on weight, performance, and cost parameters. To fully evaluate the potential advantages of the system, a more detailed study of other parameters is necessary. Requiring further analysis are: (1) aircraft installation considerations, (2) maintenance, (3) reliability, (4) life cycle cost, (5) logistics, (6) vulnerability. The advanced scout helicopter (ASH) will be used as the basis for the evaluation. This will allow identification of mission requirements, propulsion engine size or model, ambient requirements (temperature and altitude), etc., in order to make comparisons and evaluations using actual data rather than assumed values or subjective comparisons.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0002, HIGH-TEMPERATURE RADIAL TURBINE DEMONSTRATION - ARMY HELICOPTER
R.W. VERSHURE, Signal Companies Incorporated, *Phoenix, Arizona* 85034 (DA0D4114; DAAJ02-77-C-0032)

To provide and demonstrate the technology required to economically manufacture a cooled, high-temperature, radial turbine with sufficient integrity and aerodynamic performance to meet future Army requirements for reliable, low-cost, high-performance, small gas turbine engines.

The program will be conducted in three phases: Phase I - detailed design and manufacturing activity development; Phase II - prototype wheel fabrication; Phase III - mechanical integrity verification. The process will consist of photoetching thin sheets of laminates of astroloy. This is followed by stacking and bonding the sheets. The resulting component is then finished-machined to the desired external contours.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0003, AIRCRAFT SYSTEMS SYNTHESIS
R.M. CARLSON, U.S. Army, Air Mobility Res. & Dev. Lab., *Moffett Field, California* 94035 (DA0C3521)

The objective is to generate a unified direction, coordinated performance, and maximum exploitation to effect a comprehensive and balanced Army aviation research and development program responsive to army aviation systems requirements and major thrusts.

The overall approach involves ascertaining needs and requirements of advanced airmobile systems; conducting airmobile technology assessments with technological forecasting; translating operational goals to technical objectives; providing continual analysis and assessment of technological risks to identify technological voids which may limit future development; and effecting a balanced RDT & E program via a systematic resource allocation scheme.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Ames Research Center

1.0004, AERONAUTICAL TECHNOLOGY, TECHNICAL AREA I - AERODYNAMICS TECHNOLOGY
I.C. STATLER, U.S. Natl. Aero. & Space Adm., Ames Research Center, *Moffett Field, California* 94035 (DA0B5000)

Implement a rotor research program to study the influence of rotor blade design, aerodynamic characteristics, and compressibility effects on rotor performance, vibration, and noise. Provide the technology base on which to establish realistic rotary-wing handling qualities criteria and to evaluate handling qualities of proposed rotary-wing systems.

In joint participation with NASA, fabricate a multipurpose rotor test system for use in the NASA-Ames 40 by 80 ft wind tunnel, with capability for testing articulated, teetering or hingeless rotors. In joint participation with NASA, implement a coordinated and integrated program of analyses, experiment, simulation, and flight test, considering various combinations of helicopter flying characteristics, stability and control augmentation, light intensifiers, and displays.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Ames Research Center

1.0005, AIR MOBILITY TECHNICAL AREA I - AERONAUTICAL SCIENCES/AERODYNAMICS
I.C. STATLER, U.S. Natl. Aero. & Space Adm., Ames Research Center, *Moffett Field, California* 94035 (DA0C5000)

Conduct basic and applied research in joint participation with the NASA-Ames Research Center to provide a technological base in the aerodynamics of rotary-wing and other V/STOL aircraft. The objective is to expand the technologies in those areas which are most likely to impact improved operational and cost effectiveness, survivability and safety of future Army air mobile systems.

Analytical and experimental studies are selected on the basis of a continual review of the Army's aviation objectives and assessment of those fundamental technologies deficiencies which would prevent achievement of the desired objectives. Rotary-wing research will be conducted to develop or improve analytical tools, prediction techniques, and fundamental understanding related to the basic fluid mechanics, acoustics, rotary-wing dynamics and control and flight simulation, and are influenced by the availabili-

ty of technical personnel and facilities, such as, the 7 by 10 ft low-speed wind tunnel, rotor hover performance acoutic test area, ground-based simulators, computation facilities, and other unique NASA-Ames facilities and support which can be applied to the Army's rotary-wing problems.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Ames Research Center

1.0006, IN-HOUSE LABORATORY INDEPENDENT RESEARCH PROGRAM (ILIR)- ROTOR ACOUSTIC RESEARCH

I.C. STATLER, U.S. Natl. Aero. & Space Adm., Ames Research Center, *Moffett Field, California* 94035 (DA0D5002)

The objective is to make maximum utilization of the information inherent in the radiated aerodynamically generated noise signature of rotors obtained by the newly developed in-flight noise measurement technique. These measurements provide noise pressure signals undistorted by reverberation, Doppler shift and other normally prevalent signal distortion mechanisms. These research efforts should provide the understanding of the noise generation mechanisms necessary to develop relatively simple mathmatical analysis which can be used for rotor noise source and radiation pattern prediction.

A combined experimental theoretical effort will be followed utilizing tools developed to separate the noise generation mechanisms and allow concentrated effort to solve the complex problems in a step-by-step fashion. The first effort will be to define the impulsive noise generation mechanism and provide theoretical prediction capability. The second phase will concentrate on the blade vortex interaction noise and determine influence of rotor blade geometric parameters on rotor noise. Model rotor experimental efforts will utilize the laser velocimeter and other techniques such as Schlieren and shadowgraph to verify flow field disturbance patterns.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0007, VERIFICATION OF ADVANCED VIBRATION TEST CONCEPT UTILIZING SIMULATED HUB FORCES

R. JONES, Kaman Aerospace Corporation, *Bloomfield, Connecticut* 06002 (DA0D4111; DAAJ02-77-C-0027)

Demonstrate the applicability of a technique known as force determination for determining helicopter hub loads (vibrator forces and moments) directly from measured fuselage accelerations, and establish a method for conducting ground-based test conditions, known as 'ground-flying,' that duplicate in-flight vibratory loads and responses in a helicopter system.

A full-scale Army inventory helicopter will be flight tested to record fuselage responses, and calibrated in a ground vibration (shake) test. Using the calibrated response mobility matrix and the measured in-flight fuselage responses, determine the in-flight hub loads (vibratory forces and moments). Shake test the vehicle using these hub loads, comparing the in-flight and shake test responses thereby verifying the technique.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0008, TURBINE TIP CLEARANCE MEASUREMENT, ARMY AIRCRAFT

S.D. WHITE, Avco Corporation, *Stratford, Connecticut* 06497 (DA0D4010; DAAJ02-75-C-0051)

The objective is to obtain realistic data including accurate tip clearance measurements for use in evaluating, validating and refining turbine tip clearance prediction techniques in order to provide the gas turbine designer with a useful tool for analyzing operating tip clearances and for designing effective tip clearance control techniques. The resulting tip clearance reductions will provide improved performance in small gas turbine engines yielding reduced fuel consumption at all engine power levels and minimizing hardware damage during engine development.

The approach will be to generate transient and steady-state data on both the rotating and static components of the Lycoming Stagg gas generator first-stage turbine during actual full-power operation, and use the data to substantiate the various rotor/shroud growth calculation techniques used in tip clearance prediction. Final comparison will be made to actual measured tip clearance which will be obtained utilizing advanced laser-optics instrumentation developed under a previous Eustis Directorate contract. The data will not only provide a basis for analytical tool refinement, but will also describe the actual real-time response of the turbine components including the cantilevered-type shroud typical of many Army gas turbine engines.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0009, SEPARATOR SCAVENGE INVESTIGATION, ARMY AIRCRAFT ENGINES

M.J. ZOCCOLI, Avco Corporation, *Stratford, Connecticut* 06497 (DA0D3988; DAAJ02-75-C-0026)

To investigate the various means of removing the sand and dust-laden scavenge air from an integral engine inlet particle separator with the objective of providing a scavenge system which is more efficient and more durable than those currently being used. The benefits of such a system will be twofold. First, the improved efficiency will result in modest increases in power available to the aircraft and a modest improvement in SFC. Second, and most important, the improved durability will improve the engine reliability and maintainability which will result in increased aircraft availability.

Conduct a parametric analysis of each of several potential separator scavenge systems to evaluate the potential efficiency and inherent reliability of each system. Based on the above analysis select the most promising system and identify critical components of an alternate system. Conduct detailed design of the selected system and the critical components of the alternate system followed by fabrication and validation testing.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0010, HELICOPTER DRIVE SYSTEM R&M DESIGN GUIDE

K. KELLER, United Aircraft Corporation, *Stratford, Connecticut* 06602 (DA0D4084; DAAJ02-76-C-0047)

Establish detail R&M design and test criteria for helicopter drive systems. Criteria are to be developed in both quantitative and qualitative forms.

A guide will be developed to qualitatively and quantitatively relate pertinent design, development, and manufacturing issues to the ultimate achieved reliability and maintainability characteristics of helicopter drive system components. The guide will incorporate results of previous drive system work as well as criteria developed under this work.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0011, DSTR/501-M62B DYNAMIC INTERFACE DOCUMENTATION

W.H. PARKER, General Motors Corporation, *Indianapolis, Indiana* 46206 (DA0D4078; DAAJ02-76-C-0072)

To document to the extent possible the investigation into the DSTR/501-M62B dynamic interface problem and the resulting solution.

A. Conduct a search of existing engine and airframe files related to the interface problem. All reports, memoranda, calculation design studies, etc., shall be collected for use in documenting the investigations. B. Prepare a final report which will identify the problem, present the investigations leading to a solution, and describe the resulting configuration.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0012, DEVELOPMENT OF A NICAD BATTERY INTERFACE UNIT - ARMY AIRCRAFT
C. THOMAS, Chrysler Corporation, *New Orleans, Louisiana* 70129 (DA0D4061; DAAJ02-76-C-0054)

Develop an interface between the onboard nicad battery and the electrical system for aircraft in the field and upcoming aircraft (UTTAS, AAH) which will result in the safe, cost-effective use of nickel cadmium batteries. The interface will be designed to accommodate a given battery size (11AH, 34AH, etc.) and will be common to all aircraft using that battery size.

The technical objectives of this program can best be accomplished as follows: a. Define the required/desired features in an interface unit. B. Design and fabricate or procure off-the-shelf units. C. Test to verify compliance with requirements. D. Supply prototype units for field evaluation.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0013, FABRICATION OF EXPERIMENTAL PLUME IR SUPPRESSION SYSTEM - ARMY AIRCRAFT
T. CHEW, General Electric Company, *Lynn, Massachusetts* 01910 (DA0D4072; DAAJ02-76-C-0063)

Fabrication of the experimental plume suppression system developed and designed under previous efforts (contracts 73-C-0048 and 75-C-0027) for AMRDL performance evaluation and countermeasure effectiveness.

Fabricate and fit-check flight-weight hardware from the design developed under previous contract. This design incorporates into one suppression system the latest plume suppression technology with hot-parts suppression technology. Support flight performance and suppression evaluation to be conducted by AMRDL.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0014, EVALUATION OF ADVANCED TECHNOLOGY FUEL FLOW SENSOR - ARMY AIRCRAFT
L. LYNNWORTH, Panametrics Incorporated, *Waltham, Massachusetts* 02154 (DA0D4048; DAAJ02-76-C-0030)

The objective of this effort will be an advanced development evaluation of an ultrasonic fuel flow indicator that will be used to provide mass fuel flow information for diagnostic systems and for helicopter lift margin indicating systems where engine performance calculations will be necessary. Development efforts associated with diagnostic systems and lift margin systems have recognized the need for an accurate mass fuel flow measurement device which currently is not available.

Accurate and reliable fuel flow sensing is needed for meaningful engine diagnostic and fuel control applications. Prior year work has investigated a non-intrusive ultrasonic approach to flow measurement which appears worthy of further pursuit. Laboratory and test cell work with the earlier hardware has shown the concept to be good and to have the characteristics of accuracy within 1 percent of point and to be very repeatable. The present design incorporates a flow range from 50 to 4,000 pounds per hour. This range is greater than would be needed for any one engine and the reduction of the range of operation will allow even greater accuracy to be attained. The range of the flow sensor will match that needed for the T-53 and the T-700 engine. Two sensors will be designed and fabricated for field evaluation.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0015, HIGH-TEMPERATURE PROPERTIES OF EUTECTICS AND DIRECTIONALLY SOLIDIFIED ALLOYS FOR POTENTIAL ARMY AIRCRAFT ENGINES
P.J. AHEARN, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0C4808)

High-temperature materials are required for a number of Army applications which must show high strength and long-time microstructural stability. Ease of fabricability of large sections is often a second criterion. Properly chosen eutectic alloys may provide the optimum turbine blades and vanes.

High-strength castings of eutectic alloys will be prepared. Mechanical properties of eutectics are influenced by the solidification parameters. Currently properties are optimized by rapid cooling in combination with directional solidification. This procedure has practical limitations and thus experiments will be conducted to develop an alternate technique. Major emphasis will be placed upon structural modifications resulting from controlled liquid flows at the solidification interface. Modulated structures have been obtained by the technique. Further experimental adjustments should allow other interesting structural variations.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Materials & Mechanics Research Center

1.0016, COMPOSITE TURBINE BLADES FOR TURBINE ENGINES
I. AHMAD, U.S. Army, Res. Directorate, *Watervliet, New York* 12189 (DA0A1708)

Development of high-strength filament reinforced superalloy composites suitable for fabricating turbine blade/vanes for Army helicopter engines, capable of performing in the temperature range of 1900-2000 degrees F. This project is in direct support of the Army aviation materials plan.

Parameter for casting W-2 percent ThO2 FIL-modified MAR M322 alloy composite in the form of blades for helicopter engine such as T-700 will be investigated. Further studies on the impact strength and thermal fatigue properties of this system will be made. Also the application of oxidation and hot corrosion resistant coatings on this composite, and their effect on thermal fatigue will be evaluated. Composites of W coated SIC (C) filaments in superalloys will be made and their stress rupture and thermal fatigue properties will be determined. Also CVD processes for coating this filament with W, TAC and HfC will be further optimized.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Benet Weapons Lab.

1.0017, RESEARCH IN PROPULSION
C.L. WALKER, U.S. Army, Air Mobility Res. & Dev. Lab., *Cleveland, Ohio* 44135 (DA0E3533)

In joint participation with NASA-Lewis Research Center, conduct a fundamental and exploratory program of basic research to provide a technological base in the general areas of small turbine engines and helicopter drive-train systems. Topics also include advanced materials as well as design and analysis techniques.

Specific areas of study are selected on the basis of a continual review of the Army's aviation objective and assessment of those fundamental technological deficiencies which prevent or impede achievement of the objectives. The technology base is continually expanded through research effort for engine and drive-train components, including materials, processes and heat tranfer. Consideration is also given for understanding ways to adopt technology from larger engines to use in small sizes applicable to army aviation.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0018, PROPULSION TECHNOLOGY
E.E. BAILEY, U.S. Natl. Aero. & Space Adm., Lewis Research Center, *Cleveland, Ohio* 44199 (DA0E3532)

Conduct exploratory development programs for advanced propulsion and drive train components relevant to future Army aircraft application. Provide technological basis for evaluation of concepts for improvement and application including considerations for related needs in materials and fabrication techniques.

Analytical and experimental studies are conducted on Army-funded NASA-administered contracts with private industry and

universities. Typical programs involve analysis, design, fabrication, and test of breadboard hardware. The primary areas to be emphasized are related to turboshaft engine technology and associated helicopter drive-train systems. Components considered include: inlet particle separators, compressors, combustors, turbines, seals, bearings, shafting, gears, clutches, couplings, and thrust producers.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0019, ROTOR HUB GLINT REDUCTION - ARMY HELICOPTERS

J.R. CARVER, Rockwell International Corp., *Tulsa, Oklahoma* 74115 (DA0D4032; DAAJ02-76-C-0009)

To investigate the feasibility of developing a material cover for helicopter main rotor hub area components that have the visual, infrared, and radar characteristics necessary to reduce the glint detectability of the aircraft. At the same time, this cover is to be lightweight, and easily removed and replaced so as to permit preflight inspection of the main rotor components.

This program will be conducted in two phases. Phase I, material properties investigation, will be the review and selection of suitable materials for the rotor hub cover system considering helicopter performance parameters, maintenance, and environmental conditions in addition to the infrared, visual, and radar reduction properties. Phase II, design and fabrication of rotor cover, will emphasize the design and fabrication of two sets of main rotor hub glint reduction hardware.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0020, HELICOPTER TRANSMISSION VIBRATION AND NOISE REDUCTION PROGRAM

J. SCIARRA, Boeing Company, *Philadelphia, Pennsylvania* 19142 (DA0D3930; DAAJ02-74-C-0040)

To generate clear, concise and usable, analytical tools that would, during the design stage of a program, allow the design team the capability to perform trade studies that would yield drive train components that are dynamically quiet, with inherently longer life and reduced vibration and attendant noise levels.

(1) Construct analytical prediction technique and predict vibration/noise levels of baseline transmission, (2) refine analysis/design and fabricate components to reduce vibration/noise levels of baseline transmission, (3) test modified transmission, (4) compare results and conduct users conference.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0021, CONFIGURATION AERODYNAMICS FOR SINGLE ROTOR HELICOPTERS

P. SHERIDAN, Boeing Company, *Philadelphia, Pennsylvania* 19142 (DA0D4104; DAAJ02-77-C-0020)

Investigate single rotor helicopter configuration interactional aerodynamics and develop a set of generalized configuration guidelines for design and operation of single rotor helicopters.

Reduce existing wind tunnel test data of a 1/5th scale UTTAS model (YUH-61A) and segregate according to aerodynamic interactions-analyze test data and plot significant parameters and develop design guidelines for the various aerodynamic interactions.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0022, STRUCTURAL CRASHWORTHINESS SIMULATION AND ANALYSIS, ARMY HELICOPTERS

A. TANNER, Boeing Company, *Philadelphia, Pennsylvania* 19142 (DA0D4004; DAAJ02-75-C-0014)

Formulate and verify by structural specimen testing, cost-effective analytical and simulation techniques which will enhance the crashworthy helicopter structural design process.

Current helicopter structural crashworthiness analytical practices will be investigated. Designer oriented analytical techniques for predicting structural crash impact behavior shall be developed and their validity assessed by static and dynamic testing of helicopter structural sections. It will be demonstrated how the analyses and test data generated in conjunction with the structural crashworthiness simulation computer program KRASH can facilitate the crashworthiness of a helicopter design. Improvements to KRASH will be recommended and a proposed structural crashworthiness design guide prepared.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0023, THE DEVELOPMENT & APPLICATION OF A SIMPLE METHOD FOR DETERMINING UNSTEADY AIRLOADS IN SUBSONIC COMPRESSIBLE FLOW 11695-E

W.P. JONES, Texas A & M University System, School of Engineering, *College Station, Texas* 77843 (DA0E8919; DAAG29 76 G0241)

To study unsteady aerodynamic theory relating to the determination of the airloads on aircraft and helicopters in high-speed subsonic flight. Work in progress at AMRDL-Langley for predicting lifting surface loads on hovering and advancing rotors is similar to the approach proposed by Jones and Rao. This proposal is directly related to developing technology for reducing both cost and time in performing load analyses on Army helicopters.

A simple numerical lifting surface technique based on the velocity potential formulation for calculating the aerodynamic coefficients on oscillating wings and advancing rotors is to be utilized.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

1.0024, VIBRATORY ICE PROTECTION CONCEPT FOR HELICOPTER ROTOR BLADES

H. UPTON, Bell Helicopter Company, *Fort Worth, Texas* 76101 (DA0D4066; DAAJ02-76-C-0051)

To assess the effectiveness of the vibratory rotor blade deicing concept for application to various rotor blade designs such as the OH-58A, UH-1, AH-1, CH-47, UTTAS, AAH, and ASH.

Analytical assessments will be made of five (5) methods of exciting rotor blade vibratory modes necessary to cause ice shedding in a controlled manner. Various design characteristics will be estimated such as weight, energy requirements, R&M, cost, performance penalties, and impact of vibratory modes upon helicopter component fatigue life. Laboratory tests will be conducted to examine various methods of system control, demonstrate functional capabilities and identify and evaluate functional problem areas.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0025, AN EXPERIMENTAL INVESTIGATION INTO THE AERODYNAMIC OUT-OF-PLANE FORCES ON SLENDER BODIES AT HIGH ANGLES OF ATTACK

B. HUNT, Univ. of Bristol, *Bristol, England, United Kingdom* (DA0D9348; DAERO 77 G0073)

The objective of the study is to experimentally determine the side forces on slender bodies at high angles of attack.

Extreme care will be taken to establish a steady flow pattern. This will be achieved by the use of rigidly mounted models in low-turbulence wind tunnels (the 4 x 3ft tunnel of the Royal Aircraft Establishment, Farnborough) and will be checked by continuously monitoring the time-dependent behaviour of the flow. Pressure distributions will be collected over both the nose and the body of a circular cylinder fitted with a range of shape and spherically-blunted noses. Tests will be conducted for incidences from

25 percent to 80 percent and for both subcritical and postcritical Reynolds number ranges. The pressures will be integrated to yield side and normal force distributions and the results will be used to improve an existing prediction method and to assist in understanding the flow field.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Research & Standardization Group

1.0026, RESEARCH IN AERODYNAMICS
J.L. SHIPLEY, U.S. Natl. Aero. & Space Adm., Langley Research Center, *Hampton, Virginia* 23665 (DA0E3553)

To conduct basic and applied research to develop or improve analytical techniques, prediction techniques, measurement techniques, and design data related to rotary wing airfoil development, unsteady aerodynamic phenomena, rotor wake characteristics, and tip vortex generation and propagation. Investigations are selected based on continual review of the Army's aviation objectives and assessment of those fundamental technology shortcomings which would prevent or restrict achievement of these objectives.

In joint participation with NASA, analytical and experimental programs will be conducted to develop rotor airfoils which are based on mission profiles and empirically derived environments. Unsteady experimental and analytical research will be conducted to develop an understanding of and the capability to analyze and predict rotor unsteady aerodynamic characteristics. Experimental programs will be conducted to quantify rotor wakes, to develop methods for drag reduction and to determine rotor performance and helicopter interference effects.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0027, RPV PROPELLER NOISE REDUCTION STUDY
R.P. WHITE, Systems Research Labs. Inc., *Newport News, Virginia* 23602 (DA0D4109; DAAJ02-77-C-0029)

The technical objective is to evaluate and establish low noise features for design of small size low acoustically detectable propellers applicable to conceptual remotely piloted vehicle (RPV) aircraft.

This investigation will review past and present efforts covering the acoustic aspects of small-scale propellers. Ten propellers and two shrouds will be designed and fabricated to accommodate a 220 lb. RPV aircraft. Aural detectability shall be the design driver in selecting various plane forms, shapes and blade numbers. The propellers and shrouds will undergo both static and dynamic tests in both tractor and pusher configurations. Performance and aural detectability will be closely investigated to provide guidance and tradeoff data for design of low-noise RPV propellers.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0028, HT RM 75-28- ADVANCED TECHNOLOGY HELICOPTER EXTERNAL CARGO SLINGS
S. HOLA, U.S. Army, Air Mobility Res. & Dev. Lab., *Newport News, Virginia* 23604 (DA0D3978)

To advance the technology of helicopter external cargo slings to reduce weight, increase flexibility and improve handling qualities.

Perform a survey to determine the most promising of newly developed materials (such as Kevlar PRD 29). Investigate various material construction techniques and end fitting attachment methods. Perform tensile, fatigue, vibratory and environmental tests on selected material specimens by utilizing other government agencies, e.g., National Bureau of Standards, and AMMRC. Deliver a quantity of sling legs, compatible with existing attachment hardware, to the government for flight testing.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

1.0029, HT 74-16- FIELD APPLICATION OF SONIC ANALYSIS
R.J. HUNTHAUSEN, U.S. Army, Air Mobility Res. & Dev. Lab., *Newport News, Virginia* 23604 (DA0D3935)

Further investigate the feasibility of applying acoustic acquisition and analysis techniques to inspect and diagnose the mechanical condition of helicopter engines, transmissions and gearboxes without disassembling or removing these components from the aircraft. Significant safety and maintenance benefits could be accrued from this work.

Analyze the acoustic signatures of two high-time UH-1 helicopters whose engines and powertrain components are implanted with degrated gears and bearings. Data will be acquired on the ground at various rotor speeds via condenser microphones selectively positioned next to the aircraft. Frequencies approaching 100kHz will be recoverable.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0030, LASER PASSIVE COUNTERMEASURES CONCEPTS
R. BLAISDELL, Boeing Company, *Seattle, Washington* 98108 (DA0D4055; DAAJ02-76-C-0017)

Investigate AH-1G high-energy laser vulnerability and countermeasures concepts.

Establish AH-1G baseline high-energy laser vulnerability by analysis supplemented with test data, where available. This will be the evaluation of the reduction in high-energy laser vulnerability after various countermeasures are applied. Impact on aircraft performance, mission accomplishment, cost, etc., will be evaluated.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0031, AEROSOL LASER PASSIVE COUNTERMEASURES CONCEPTUAL DEVELOPMENT
K. BRENTMAN, Boeing Company, *Seattle, Washington* 98108 (DA0D4089; DAAJ02-77-C-0005)

Investigate aerosol/smoke systems compatible with the AH-1 helicopter that have the potential of providing laser designator/visual countermeasure capability.

Phase I will identify and document SOA with respect to aerosol/smoke formulations, dispensing systems and delivery systems responsive to mission requirements. Phase II will involve the conceptual development of candidate countermeasures systems.

SUPPORTED BY U.S. Dept. of Defense, Aviation Systems Command, Air Mobility Research & Development Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, FIBER ABRASION RESISTANCE OF HASPA SKIN MATERIALS
J.V. DUFFY, U.S. Navy, Surface Weapons Center, *Silver Spring, Maryland* 20910 (DN785062)

To investigate methods of improving abrasion resistance of Kevlar yarns presently used as skin reinforcement in the HASPA aerostat.

To reduce fiber abrasion experienced during flight preparation and operation of the aerostat, the use of an elastomeric coating on the outside of the multifilament yarn will be investigated. A flexible polyurethane is the first choice of elastomer because of its good adhesive properties and high abrasion resistance. Other candidates include flexible epoxides and also the polyester adhesive presently used to bond the woven kevlar scrim to the mylar film.

ADDENDA: Supporting agency address is: Office of Naval Research, Department of the Navy, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense, Navy

3.0002, X-RAY CHARACTERIZATION OF ARMY WEAPON SYSTEM MATERIALS
C.P. GAZZARA, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0A4771)

The general objective is to develop advanced methods and techniques for X-ray characterization of the crystal structure of materials used in Army systems. During this fiscal year, the major specific objective will be the development of an analytical technique to speed processing of X-ray diffraction data. This work is in direct support of ongoing materials analyses for major aircraft, missile and armament system components.

A convolution technique to approximate the intensity and position of a diffraction peak will be developed in order to increase the speed of X-ray quantitative phase analysis, texture and lattice constant measurements. Corrections for cold work will be made. Materials to be investigated include selected aluminum and uranium alloys. A method to increase the accuracy of residual stress analysis by X-rays will be explored.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Materials & Mechanics Research Center

3.0003, FABRICATION OF COMPOSITE MATERIAL PROTOTYPE/MIXED FIBER COMPOSITES
B.M. HALPIN, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0D4741)

To provide the basis for increased effectiveness in the use of fiber resin composite materials in Army applications. Depending on the component, weight reductions of 30 to 50 percent can be expected. Composite materials may increase the lifetime and performance of many structures. Standardization of fabrication techniques will be used to increase the reproducibility of final product. The work unit responds to improved composite material for missiles and lightweight antitank weapons and for use of organic materials in vehicle and aircraft applications.

Prototypes and specimens representative of items such as missile components, vehicle drive shafts and helicopter spars will be fabricated from high-performance organic fibers, graphic fibers, and glass using new resin systems. In addition to the fibers alone in a matrix, combinations of fibers will be investigated to establish properties of hybrid configurations. The prototype study will be extended beyond filamentary composites to include structural foams. These foams will be investigated for potential use in many applications formerly employing metal housings, e.g., field radio cases.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Materials & Mechanics Research Center

3.0004, FAST FRACTURE RESISTANCE OF GLASSY POLYMERS AND FIBER COMPOSITES 11691-MS
M.F. KANNINEN, Battelle Memorial Institute, *Columbus, Ohio* 43201 (DA0C5578; DAAG29 77 G0119)

Characterization of the unstable propagation and the arrest of cracks in polymers and polymer-based composites. Relevance - the proposed research is directly relevant to failure of polymers and composite materials which are subject to impact loads. The Army is committed to using large amounts of such materials for missile launch tubes, rocket casings, ammunition cases, boats, back-up plates for personnel armor, helicopter components, helmet liners, canteens, containers of various types, etc. The chief cause of failure of these materials is propagation of cracks generated by impact loads or cyclic loading.

The program will include, but will not be limited to, the following: (1) modification of the so-called beam-on-elastic-foundation model of the double cantilever beam specimen to account for the impact loading of a specimen containing a sharp notch; (2) measurement of the velocity of crack propagation as a function of crack length for polymers and polymeric composites which are reinforced with graphite or glass fibers; (3) development of an analysis capable of extracting the relationship between dynamic fracture toughness and crack velocity in these materials.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

3.0005, HIGH SOLIDS COATINGS DEVELOPMENT
M.J. MOSCYNSKI, U.S. Air Force, Materials Laboratory, *Dayton, Ohio* 45433 (D7-F1132; B604B-605)

OBJECTIVE: Development of a high-performance polyurethane exterior aircraft coating with a minimum of 65% volume solids, suitable for application with airless electrostatic spray equipment.

APPROACH: Investigation of novel combinations of commercially available polyols and isocyanates, and investigations with specially modified polymer resins.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Industrial Environmental Research Lab.

3.0006, STRUCTURAL STUDIES OF MONOMERIC MODEL COMPOUNDS AND RELATED ORDERED POLYMER SYSTEMS
A.V. FRATINI, Univ. of Dayton, School of Arts & Sciences, *Dayton, Ohio* 45469 (DF047740; AF-AFOSR-3267-77)

AF function - advanced aircraft will utilize large area, lightweight structural composites which will require sustained performance in severe environments. Deficiency - the processing, property and microstructure interrelations for the design of composite matrix materials which will provide sustained performance have not been established. Objective -explore the relationship between structure and physical and chemical properties in paraconfigured polybenzoxazoles (pbo) polymers by the determination of X-ray structures of monomeric compounds capable of functioning as model compounds. How work contributes - this research will support the AFML/AFOSR study of ordered, aromatic-heterocyclic polymer systems in search of new nonmetallic materials that can function as self-reinforced composites.

(1) Single crystal X-ray diffraction studies of model compounds with emphasis on detailed structural parameters of the bisoxazole moiety in a variety of environments, the effect of bulky substituents on the conformation of the polymer backbone, and knowledge of the gross packing features of the polymer chains and (2) dynamic X-ray diffraction imaging studies centered on correlation of microstructure to physical properties, and observation of changes in morphology with simultaneous mechanical deformation.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NC, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

3.0007, NAVY VEHICLE DESIGN AND CONSTRUCTION - ORIENTED POLYMERS
J.L. WHITE, Univ. of Tennessee, School of Engineering, *Knoxville, Tennessee* 37916 (DN775285; N00014-77-C-0236)

New polymeric compositions of high strength are of interest to the Navy for improved lightweight composites because lightweight organic structural materials can provide much improved payload/weight ratios in aircraft and surface effect ships. The proposed research will provide new materials and theoretical models to meet Navy needs in this area.

This work will be directed toward the preparation of biaxially oriented aromatic polyamide films from liquid crystalline polymer solutions. Experiments will be carried out to determine whether the successful one-dimensional approach utilized for fiber spinning can be extended to other shapes and structures.

ADDENDA: supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense, Navy

3.0008, STRESS-INDUCED EFFECTS UPON STRUCTURE AND PROPERTIES OF CARBON FIBERS 13458-MS
D.B. FISCHBACH, Univ. of Washington, School of Engineering, *Seattle, Washington* 98105 (DA0E9045; DAAG29 76 G0169)

To study the stress-induced physical behavior of carbon fibers and the detailed influence of microstructure on their piezoresistance and dynamic mechanical properties. This research is relevant to the Army's need for stronger, stiffer, and less expensive lightweight fibers for reinforcement for composite

materials for Army aircraft, missiles, and electrical power storage and distribution. Graphite reinforced metal matrix composites are being proposed for bridge supports, storage batteries, helicopter transmission housings, turbine fan blades, and parts of the super flywheel.

The program will include: (1) determination of the effects of various thermal treatments on structure and properties, (2) study of the structure and properties of new pitch-mesophase and CVD carbon fibers, (3) determination of the temperature-dependence of the dynamic mechanical relaxation effects in the range 100-500K, (4) characterization of the microstructure of carbon fibers using such techniques as electron microscopy, X-ray diffraction, magnetic measurements, and (5) formulation of an analytical anisotropic elasticity model.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, LASER STUDIES OF MOLECULAR COLLISION PROCESSES 12224-P

C.B. MOORE, Univ. of California, School of Chemistry, *Berkeley, California* 94720 (DA0D9286; DAHC04-74-G-0148)

To conduct a series of experiments which are designed to give rates for many different energy transfer and chemical reaction processes. The proposed program is relevant to the development of high-power chemical lasers, and attempts to enhance the efficiency of lasers involving electronic transitions using chemical reactions.

Systems such as F-H-F, H-H-F, O-H-H, etc., for which accurate configuration interaction potential surfaces can be calculated, will be studied. Experiments on electronic-to-vibration energy transfer will be studied for a wide variety of collision partners in order to establish a sound empirical base on which to build the more detailed studies.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

4.0002, INVESTIGATION OF JUNCTION FIELD EFFECT TRANSISTORS

K. LEHOVEC, Univ. of Southern California, School of Engineering, *Los Angeles, California* 90007 (ENG76-84530)

The objective of this program is the electrical characterization of the interface between a semiconducting channel and an insulating substrate to determine those electrical parameters which are of importance for field effect transistor design. The semiconductor-substrate combinations to be studied are silicon on sapphire, and semiconducting gallium arsenide on semi-insulating gallium arsenide.

The Shockley-Read-Hall parameters pertaining to the surface states at the silicon-sapphire interface will be derived by (1) applying and extending the transient current method recently developed under this program and (2) by using the standard metal-oxide-semiconductor capacitance-voltage and resistance-voltage methods in conjunction with the metal/sapphire/interdigital silicon test structure developed in the program.

The gradual transition between an ion-implanted n-channel and a chromium doped semi-insulating gallium arsenide substrate will be studied using distributed network analysis and the dual bias method for determining impurity profiles. The latter method eliminates the ambiguities arising from capacitance-voltage measurements with nearly pinched-off channels. This is a continuation of research under NSF grant ENG-7405551.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0003, THE ELECTRICAL AND METALLURGICAL PROPERTIES OF DEFECTS IN COMPOUND SEMICONDUCTORS 12892-EL

G.L. PEARSON, Stanford University, School of Engineering, *Palo Alto, California* 94305 (DA0E5574; DAAG29 75 C 0013)

To investigate the effect of vacancies and crystal defects on the electronic properties in compound semiconductors. Relevance - binary and ternary semiconductor compounds are essential materials for extremely high frequency devices, such as Impatt or Gunn diodes, and for electrooptical applications such as in photocathodes.

Identification of vacancy defects and vacancy-impurity complexes in AlGaAs: determination of energy levels associated with Ga and As vacancies and their formation energies in GaAs.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

4.0004, GOES SATELLITE TIMING SYSTEM/P&F

D.W. HANSON, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Boulder, Colorado* 80302 (2776043)

PURPOSE: The development of techniques and tools for transferring time and frequency information at all levels of precision and user sophistication.

OBJECTIVES: To develop the techniques and tools to use satellites for comparison of NBS time scales with laboratories worldwide and to develop a satellite broadcast system that will allow the retirement of the NBS broadcast services of WWV, WWVH, and possibly WWVB.

FY77 MILESTONES: (1) To continue GOES time code effort with emphasis on evaluation of performance, orbit determination, software, and signal recovery techniques; (2) To contribute to time code extension to European and Japanese satellites.

ACCOMPLISHMENTS: Time code was broadcast continuously on both GOES satellites. A satellite-controlled digital clock for recovery and use of time code was designed and patented. An improved, automated time comparison system was developed for the Wallops Island satellite facility to permit better comparison between UTC(NBS) and the satellite clock.

BIBLIOGRAPHIC REFERENCE: Cateora, J.V., Davis, D.D., Hanson, D.W., A satellite-controlled digital clock; NBS Tech. Note 681, 6/76.

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards

4.0005, MICROWAVE RELAXATION AND MICROSTRUCTURE IN POLYCRYSTALLINE FERRITES12240-EL

C.E. PATTON, Colorado State University, School of Science, *Fort Collins, Colorado* 80523 (DA0E8972; DAHC04-75-G-0010)

To investigate mechanisms which determine the microwave losses in polycrystalline ferrites in order to provide a generally valid picture of ferrite relaxation and to give a basis for improved materials development. Phase shifters contribute the biggest share to the cost of phased arrays. This proposal aims at improving technology with respect to performance and price of ferrites to be used in phase shifters. Primary potential payoff will occur in SAM-D phased arrays.

The temperature and frequency dependence of spinwave linewidth, transit-time relaxation, magnetostriction and other loss mechanisms will be investigated for Li-ferrite and YIG by systematic variation in microstructure parameters. Also, correlation between microstructure and high-power properties will be made.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

4.0006, AERODYNAMIC MEASUREMENTS

J.M. MCMICHAEL, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234 (2130180)

PURPOSE: To improve the technical base for aerodynamic measurements, and provide the extended measurement services in aerodynamics needed by the nation's technology.

OBJECTIVES: 1) To provide an improved theoretical understanding and experimental evaluation of behavior of wind speed measuring instruments in unsteady flows. 2) Develop capabilities for measuring and characterizing the dynamic response of wind speed measuring instruments. 3) Develop capabilities for making very low velocity measurements.

FY77 MILESTONES: Prepare report on fluid-dynamics of unsteady flow facilities, December 1976. Prepare report on development of low-velocity calibration facility, December 1976. Prepare report on nonlinear spectral characteristics of a helicoid anemometer, January 1977. Re-evaluate uncertainties and methods for airspeed calibrations with Pitot-static tubes, May 1977. Evaluate state-of-the-art of low-velocity anemometers as candidate transfer standards (see OA 2130483), October 1977.

ACCOMPLISHMENTS: Evaluated static and dynamic response of Gill anemometer and prepared report (NBSIR 75-772). Completed implementation and evaluation of unsteady flow facility including gust and lull mode. Low-velocity air facility and laser velocimeter evaluated and established as an operational standard. Calibration service on a routine and economical basis for the dynamical performance of anemometers established.

BIBLIOGRAPHIC REFERENCES: J.M. McMichael, P.S. Klebanoff: 'The Dynamic Response of a Rotary Anemometer,' Abstract, Bulletin of the American Physical Society, series II, vol. 20, no. 11, p. 1433, November 1975. J.M. McMichael, P.S. Klebanoff, 'The Dynamic Response of Helicoid Anemometers,' NBSIR 75-772, November 1975.

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards

4.0007, ANALYSIS OF DEFLAGRATION-TO-DETONATION TRANSITION IN POROUS PROPELLANT

H. KRIER, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (AFOSR 77-3115)

Several one-dimensional, two-phase reactive flow models are being used to predict the possible deflagration-to-detonation transition (DDT) in porous solid propellant rocket grains. Combined solid and fluid mechanics analysis of propellant aggregates to predict formation of shock wave conditions is also included in this project in order to provide DDT criteria.

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0008, AMORPHOUS-SEMICONDUCTOR JUNCTION EFFECTS 11575-P

D. ADLER, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (DA0D9243; DAAG29 74 C 0006)

To study interfaces between amorphous semiconductors and other materials. Army programs in the development of radiation hard circuitry for use in severe environments are held back by a lack of fully hardened ancillary circuitry. This research has the potential of providing truly radiation hard diodes and three terminal devices which will help to fulfill this requirement. Successful achievement of the proposed goals will enable the effective use of radiation hard nonvolatile memory elements, already in existence.

Two-terminal structures involving both p- and n-type amorphous semiconductors. Two terminal sturctures with amorphous solids in contact with several well-known crystalline materials, and three-terminal structures in which amorphous semiconductors are the emitter and/or the collector will be studied. In addition, electron-bombardment-induced switching and photo-induced switching of chalcogenide glasses, photodiode behavior of the junctions, and the temperature dependence of the switching phenomena will be investigated in a consistentt manner. Finally, the feasibility of threshold devices as the switching element in liquid-crystal displays will be studied.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

4.0009, STUDY OF SURFACE FATIGUE WEAR BY EXOELECTRON EMISSION 11889-E

E. RABINOWICZ, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (DA0E8936; DAAG29 74 C 0028)

To investigate stimulated exoelectron emission as a technique for studying rolling contact fatigue. This phenomenon of wear is vital to Army interests in a myriad of situtions. For example, in all machines or devices making use of ball or roller bearings, wear is a critical factor in performance. Excessive wear of an inexpensive element can cause operation failure in a very costly and vital machine as, for example, in a helicopter rotor or a radar scanning device.

Rolling contact life tests will be conducted in a standard 4-ball rig, and at intervals take the top ball (the one which generally fials in rolling conact fatigue) and measure its exoelectron emission. When failure occurs, the failure time and location will be compared with previously observed exoelectron emission.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

4.0010, LONG PATH AIR POLLUTION MONITOR EVALUATION

F.L. BARTMAN, Univ. of Michigan, School of Engineering, *Ann Arbor, Michigan* 48106 (R803399-03; G603A-AA-12)

OBJECTIVES: To evaluate the performance of prototype air pollution monitors and to effect engineering solutions to problem areas. Emphasis has been on the evaluation of long path monitors and of monitors based on gas filter correlation.

APPROACH: To conduct laboratory and field tests in which various prototype monitors can be evaluated. Long path systems have been evaluated in regional studies in which their capabilities for area monitoring, as distinct from point monitoring, can provide useful information on the representativeness of stationary monitoring sites. Point monitors have been used in new types of applications.

CURRENT PLANS/PROGRESS: Current plans include: (1) To develop a better design for a diode laser based, long path system and in so doing to enhance stability and reliability of the present system; (2) To test two long path systems, one based on a diode laser and one based on a CO2 laser.

PROGRESS DURING THE PAST YEAR INCLUDES: (1) Redesign of a wavelength selection system for the diode laser, long path monitor; (2) Evaluation of a carbon monoxide monitor based on the optical technique of gas filter correlation (GFC); (3) Participation in a field study to determine the diffusion of CO from automobile traffic on the San Diego freeway: (4) Evaluation of data pertinent to the site representativeness of sites in the Regional Air Monitoring System in St. Louis.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

4.0011, STUDIES IN THE THEORY OF BIFURCATION, VISCOELASTIC FLUIDS, AND BIORTHOGONAL EIGENFUNCTION EXPANSIONS

D.D. JOSEPH, Univ. of Minnesota, School of Engineering, *Minneapolis, Minnesota* 55414 (ENG75-19047 A01)

This is a renewal of NSF Grant ENG 75-19047. Theoretical research shall continue in the following areas: 1) Bifurcation and stability of nT-periodic solutions branching from T-periodic solutions at points of resonance. 2) Factorization theorems and repeated bifurcation at a simple eigenvalue. 3) Biorthogonal eigenfunction expansions. 4) Perturbation of rigid motions of a viscoelastic fluid.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0012, AIRCRAFT SUPPORT FOR SPECIAL RAPS FIELD STUDIES

R.N. SNELLING, U.S. Environ. Protection Agcy., Env. Monitoring & Support Lab., *Las Vegas, Nevada* 89114 (J603B-10)

OBJECTIVE: To provide aircraft support for RAPS field study during the period October-November 1976. Data collected provides vertical extension of RAMS ground-based monitoring stations. To provide all data collected over the 3-year RAPS study period.

APPROACH: Two Sikorsky S-58 helicopters, instrumented for measurement of O3, CO, NO, NO2, SO2, visibility, temperature, dewpoint, particulates and navigational parameters will be used to collect three-dimensional air mass data.

All data will be computer processed and provided on magnetic tape to the RAPS data base.

OUTPUTS: 1. Final report for RAPS aircraft monitoring describing procedures and indexing available data. 2. Aircraft monitoring data in computer compatible format for inclusion in RAPS data base.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Support Lab.

4.0013, AIRCRAFT EMISSIONS IMPACT MONITORING

K. ZELLER, U.S. Environ. Protection Agcy., Env. Monitoring & Support Lab., *Las Vegas*, *Nevada* 89114 (J627G-78)

OBJECTIVE: An Interagency Agreement between the EPA, EMSL-LV and the U.S. Air Force Civil Engineering Center established a cooperative study to assess the impact of aircraft emissions on ambient air quality. The U.S. Navy, through the Naval Air Propulsion Test Center, is participating by providing funding and technical support through the Air Force. The data provided from the study will be used to calculate air quality frequency distributions and to validate existing airport models.

APPROACH: Collection and processing of air quality and meteorological data from five stations at Williams AFB for a 1-year period. CO, NOx, reactive hydrocarbons, and particulate data are collected. Monitoring will then be moved to Miramar Navy Air Station, San Diego, California.

OUTPUTS: 1. Final report summarizing procedures and data from Williams AFB. 2. Validated monitoring data in computer compatible format (Magnetic tape) from Williams AFB. 3. Final report summarizing procedures and data from Miramar. 4. Validated monitoring data in computer compatible format (magnetic tape) from Miramar.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Support Lab.

4.0014, LASER PROPAGATION PHENOMENA

E. COLLETT, U.S. Army, Electronic Warfare Laboratory, *Red Bank*, *New Jersey* 07703 (DA0D3052)

The objective of the present research is to provide an analytical base to describe the propagation of low- and high-power laser beams propagating in a turbulent atmosphere. Further objectives of the present research have been changed to include optical polarization phenomena. This has been done in response to Army, Air Force, and Navy interests and needs in this area.

Specifically, the Mueller-Stokes matrices for selected optical systems are presently being determined. In addition, various experimental conditions to determine the matrix elements are also being analyzed.

SUPPORTED BY U.S. Dept. of Defense, Electronics Command, Electronic Warfare Lab.

4.0015, LOW-COST OBSTACLE AVOIDANCE SYSTEM

A. KLEIDER, U.S. Army, Avionics Laboratory, *Red Bank*, *New Jersey* 07703 (DA0D2824; DAAB07-76-C-0927)

This program has been initiated to provide, at a cost which the Army can afford, a solution to the wire strike problem for helicopters flying nap-of-the-earth (NOE). The objectives include means of detection and recognition compatible with the aircraft lift capabilities, forward speed, and the expected incremental change in altitude required to clear the wire obstacle. The development of a flyable exploratory development model operable under restricted lighting conditions in clear weather is the prime program objective.

Recent developments in monolithic semiconductor devices called charge coupled devices (CCD) will be exploited in a mode of operation referred to as single site activation (SSA) to detect and recognize wire obstacles. Operating in a combined electronic and mechanical scanning mode, the characteristics of wire are utilized to extract pattern recognition information. The processed video signal is converted to a visual/audible alarm with an appropriate symbolic display. Range data and low-light-level operation are based upon the synchronous use of a pulsed gallium arsenide (GaAs) illuminator.

SUPPORTED BY U.S. Dept. of Defense, Electronics Command, Avionics Lab.

4.0016, ADVANCED DEVICE PROCESSING TECHNIQUES

J.H. BLOOM, U.S. Air Force, Rome Air Development Ctr., *Rome*, *New York* 13440 (DF902780)

AF function - communications and reconnaissance. Deficiency/opportunity - solid-state components are too expensive. Objective - research new device processing techniques that improve the control and tolerance attainable in solid-state device fabrication. How research contributes - solid-state devices that are fabricated with processes that require reduced tolerance margins can be made cheaper due to increased yield and/or increased functional complexity per chip.

Electron beam exposures of electron resists, ion implantation doping, plasma and ion etching, and electron beam evaporations as well as ion sputtered thin films will be investigated for use in solid-state device fabrication. Fundamental physics of low barrier height Schottky barrier will be investigated as a function of processing techniques. Electron beam dose requirements for submicron linewidth will be investigated as a function of available electron resist sensitivity and substrate material, i.e., semiconductor, metal or insulator. Ion implantation doping of INP and various ternary compounds will be carried out to determine doping efficiency as a function of annealing temperature and capping material. Plasma and ion beam etching will be investigated in order to increase uniformity of the etched layers and improve selectivity. Various thin film techniques will be utilized to improve the junction quality of low-work-function Schottky barriers on silicon and to produce capping layers for III-V compounds semiconductors.

ADDENDA: Supporting agency address is: Rome Air Development Center ETS, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0017, IMPROVEMENT OF GAAS CRYSTAL QUALITY

W. TANTRAPORN, General Electric Company, *Schenectady*, *New York* 12305 (DF049240; F49620-77-C-0105)

AF function - microwave solid-state electronic devices are essential components of Air Force surveillance, electronic countermeasure, and communications systems. Deficiency - the performance of GaAs microwave devices is being limited by the poor quality of the GaAs substrates used in the epitaxial growth process. The high defect density of these substrates causes high noise in microwave field effect transistors and possible complete failure in Impatt devices. Objective - the objective of this research is to develop a method of growing GaAs boules which will consistently and uniformly yield GaAs substrates of a quality superior to that now available. How work contributes - an improved substrate material will allow GaAs microwave devices to achieve higher performance levels than those now possible and thus enhance Air Force systems employing these devices.

The main idea behind this research lies in the fact that most GaAs substrates available today are grown by methods, Bridgman or Czochralski techniques, in which the liquid-solid interface is liquid-convex. This configuration leads to defect migration from the surface into the bulk of the ingot and hence concentrates the number of defects in the main part of the boule. In addition, since solid GaAs is less dense than the liquid, the liquid-convex surface results in high compressional strain, another defect source in GaAs. In this research temperature gradients from a specially designed furnace will be used to control the liquid-solid interface

and obtain a solid-convex surface. This interface shape will help to propagate defects out of the bulk and also aid in the reduction of possible elimination of compressional strain. The defects of slices in the boule will be determined by etch-pit density counts. The etch-pit density will be correlated with various radii-of-curvature for the solid convex surface.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0018, INSTRUMENT DESIGN AND CONSTRUCTION
T. LEMMONS, U.S. Environ. Protection Agcy., Environ. Sciences Res. Lab., *Durham, North Carolina* 27711 (G712B-BA-45)

OBJECTIVE: Provide service and electronic support for ESRL in-house programs.

APPROACH: Depends on discrete instrumentation problem. Work in progress includes construction of chemiluminescence analyzers for several special applications including aircraft turbine and diesel NOx emissions measurement, use as a nitrogen-specific gas chromatographic detector, and as a nickel carbonyl analyzer. Each application presents different electronic and sample handling problems.

Other work includes development of microprocessor-based engine programming and data acquisition systems for heavy-duty emissions for light-duty passenger car testing.

CURRENT PLAN/PROGRESS: 3 NOx instruments have been completed and an integrated aircraft turbine test train is being assembled. There have been delays in completion of all four chemiluminescence analyzers because of vendor problems, especially with respect to the high-quality phototubes required for the two high-priority instruments for n-specific G.C. and nickel carbonyl. Support for emissions testing has included primarily hardware-selection and software development for the heavy-duty and aircraft turbine systems. Hardware is in hand and specifications for the software development have been written and are under review. Cooling for assembler language data acquisition and control routines has not yet begun.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

4.0019, NO EXHAUST MEASUREMENT
E.L. HIVELY, Arnold Research Org. Inc., *Tullahoma, Tennessee* 37389 (DF407060)

To resolve present discrepancies between optical, in-situ and extractive probe techniques for turbine engine emissions. To show the feasibility of simpler, less costly and more accurate measuring systems for turbine engine exhaust composition measurement.

A series of controlled laboratory experiments, beginning with well understood burner systems and progressing to more dynamically complicated combustion systems using JP-4 fuel will be run. Simultaneous measurements using newly designed optical and probe systems and existing optical systems will be made. Data reduction and analysis techniques will be emphasized.

ADDENDA: Supporting agency address is: AF Civil Engineering Center EVA, Tyndall AFB, Fla 32401

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0020, SUBMILLIMETER DETECTION TECHNIQUES
T.A. RABSON, Rice University, School of Engineering, *Houston, Texas* 77001 (ENG76-81830)

The objective of this research program is to investigate optical heterodyne detection techniques in the region with wavelengths between 100 micrometers and 400 micrometers using submillimeter and microwave local oscillators together with various wideband submillimeter detectors. In particular, microwave biased extrinsic GaAs photodetectors and Schottky barrier detectors will be examined for use as the nonlinear detection element.

The fabrication of a suitable signal source and local oscillator will be an important corollary project. There are already available an HCN laser operating at 337 microns and a CO2 pumped molecular gas waveguide laser. Potential nonlinear mixing materials in the 100-400 micron wavelength region where materials are limited to a large extent by transparency consideration to cubic semiconductors and gases will be investigated. Although the research is directed towards optimization of communication receiver systems in the submillimeter wavelength region, the research will also be useful in spectroscopy, radio astronomy and plasma diagnostics.

This action renews the research supported under NSF Grant GK-43321.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, LOWER-UPPER ATMOSPHERE COUPLING DURING PERIODS OF SEVERE WEATHER 13409-MS
R.J. HUNG, Univ. of Alabama, School of Science & Engin., *Huntsville, Alabama* 35807 (DA0E9007)

To investigate the dynamics of coupling between the lower and upper atmosphere during periods of severe weather activities. The work will lead to improved methods of detecting the possibility of severe storms from use of photographs from satellites. The military interest ranges from protection of troops and equipment to taking advantage of enemy losses from severe storms. The work supplements the Army Atmospheric Sciences Laboratory satellite storm detection (SATSTM) program.

The experimental phase of the work involves improving Doppler remote sensing techniques through analysis of continuous wave Doppler signals transmitted from three sites in Alabama and received after reflection from the ionosphere at NASA/Marshall Space Flight Center, Huntsville, Alabama. The theoretical phase of the work involves calculation of infra-sonic wave properties such as mechanism of excitation, damping rate of dispersion and relationship to electron density and wind profiles.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

5.0002, GEOLOGIC APPLICATIONS OF LANDSAT IMAGES IN NORTHEASTERN ARIZONA TO THE LOCATION OF WATER SUPPLIES FOR MUNICIPAL AND INDUSTRIAL USES
K.E. FOSTER, Univ. of Arizona, Office of Arid Land Studies, *Tucson, Arizona* 85721 (B-066-ARIZ)

The general objective of this study is to develop methods for exploration of water supplies based upon linear faulting detectable from satellite imagery.

It is proposed specifically to: 1) utilize remote sensing techniques to map lineaments: 2) utilize control areas, in which detectable lineaments will be plotted in relation to known well sites; and 3) develop a systematic approach for locating areas of potentially high-production wells (defined as wells producing 500 gallons per minute or more).

SUPPORTED BY U.S. Dept. of the Interior, Office of Water Research & Technology

5.0003, SYSTEMS FOR APPLYING PESTICIDES, BIOLOGICAL AGENTS, AND PLANT NUTRIENTS
W.E. YATES, Univ. of California, Agric. Experiment Station, *Davis, California* 95616 (0002720; CA-D0-AER-1971-H)

OBJECTIVE: To protect our environment from detrimental pollution resulting from pesticide applications, and at the same time provide effective techniques for control of pests and introduction of nutrients for optimum food production.

APPROACH: Determining parameters to reduce environmental contamination will involve basic studies of atomization, dispersal methods for biological materials, evaluation of physical

properties of formulations, and remote sensing of pest infestations. The biological effectiveness of various application systems will be evaluated. The effects of microweather on aerial transport and fate of the entire droplet spectrum will be studied. Particulate drift will be related to health and ecological hazards.

PROGRESS: 1. Evaluated release rates of various microdispersible formulations of the sex pheromone for control of the pink bollworm. Two formulations were selected and aerial application techniques were tested in Coachella Valley in cooperation with UCR entomologists. 2. Conducted cooperative tests with plant pathologists on efficacy of aerial application of Captan, Difolitan, and Topsin for control of russet scab and brown rot in prune orchards. Insufficient disease developed to determine efficacy. 3. Measured spray deposits from an overtree sprinkler system used for application of fungicides during full bloom period on prune trees. Two different techniques resulted in low deposits on blossoms compared to ground air blast sprayer applications. 4. A large-scale test in rice was conducted to determine drift hazards from the application of propanil with a low drift system (Microfoil(R)) on a helicopter. Fallout sheets, air samplers and bio-assays showed detectable amounts as far as 1 mile downwind. 5. An extensive series of tests were conducted to determine drift of glyphosate from various application systems. Different nozzles and thickening agents were used on ground, fixed wing, and helicopter systems. 6. Laboratory tests were conducted on a uniform drop size atomizer. A pulsed micro-jet unit was redesigned utilizing a magnetrostrictive transducer and a new multi-jet orifice plate.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, California

5.0004, REMOTE MEASUREMENT OF AIR POLLUTANTS

E.R. MURRAY, S R I International, *Menlo Park, California* 94025 (ENV77-10198)

The present grant is a continuation of work done under Grants GI-38986 and AEN75-14997 A02. The objective is the development of laser methods for remote measurement of atmospheric levels of gases such as sulfur dioxide (SO)2, nitrogen dioxide (NO2), ozone (O3), ethylene (C2H4), and ammonia. These techniques are needed for monitoring ambient levels of gases in polluted air and for obtaining average concentrations integrated over kilometer (or longer) pathlengths to provide data for testing pollutant dispersion models. The work employs the differential absorption laser-radar (DIAL) technique whereby light transmitted from a laser source is backscattered from atmospheric particles or from topographic targets (such as a hillside). The light beam is tuned to a wavelength strongly absorbed by a molecule of interest. From the time delay between the sending and the receipt of the returned backscattered signal pulses, one can determine gas concentrations at various distances along the path. The concept has been tested for measurement of SO2 and O3 in the ultraviolet and of NO2 in the visible spectrum.

Under the present grant the investigators will demonstrate the performance of the system under different pollutant-gas levels and variable meteorological conditions. The technique will be extended to the infrared to explore the advantages of this spectral region for detection a wider variety of gases and for potentially greater detection sensitivity. Special attention will be given to ammonia and ozone in the infrared.

SUPPORTED BY U.S. National Science Foundation, Div. of Advanced Environmental Research & Technology

5.0005, DEVELOPMENT OF A PORTABLE LIDAR PLUME OPACITY INSTRUMENT

UNKNOWN, S R I International, *Menlo Park, California* 94025 (68-02-1291; G712B-BA-61)

BACKGROUND: The visibility of plumes and particulate emissions are regulated by plume opacity standards. It is probably the oldest and most used method for regulating particulate emissions to the atmosphere from stationary sources. Compliance with these standards is usually determined by the subjective evaluation of plume opacities by trained visible emissions observers. To improve the accuracy and objectivity of the opacity determination, an instrumental method is needed. Pulsed lidar has been used as an effective instrumental method for remote measurement of plume opacity; however, its application has been restricted to opacity measurement research due to its cost, size and complexity. A recent study on the feasibility of developing a new lidar method that uses a low-powered CW laser showed promise for developing the method into a small portable opacity measuring instrument for surveillance work by control agencies.

PURPOSE: This contract is for continuation of the development of the CW lidar method into a portable instrument for remote measurement of plume opacities suitable for use by Air Pollution Control Agencies.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0006, REMOTE SENSING APPLICATION

D. BERAN, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8AA70620)

PROJECT OBJECTIVE: To further the development and application of remote sensing devices, through the design of PROFS.

CURRENT YEAR PLAN: To organize and direct the detailed design of PROFS.

PROGRESS REPORT: Lidar wind monitoring project formed and underway. Outside funding for ongoing effort received.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0007, AEROSOL CHARACTERIZATION RESEARCH -- COLSTRIP, MONTANA

V.E. DERR, U.S. Dept. of Commerce, Wave Propagation Laboratory, *Boulder, Colorado* 80302 (D7-0740; M625A-054)

Project involves the measurement of the concentration of particulates categorized by size, shape and chemical constitution. Two radiation measurements will be made: (1) rate at which solar energy reaches the earth as a function of wavelength, and (2) the net heat loss of the earth will be measured by infrared radiometry by measuring upward and downward radiation and by employing aircraft and ground-based instruments.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Research Lab.

5.0008, MULTI-SENSOR CLOUDS

V.E. DERR, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8AA71531)

PROJECT OBJECTIVE: Develop and apply to atmospheric measurements a multiwavelength lidar system with radar, radiometry and solar photometry to measure geometric, statistical and optical properties of clouds and aerosols. Develop remote sensing techniques to identify clouds and aerosols.

CURRENT YEAR PLAN: Study growth processes in clouds and relation to convective boundary layer. Determine optical properties of clouds and aerosols as a function of particle parameters.

PROGRESS REPORT: Further statistics of orographic cloud geometry have been obtained. Generation by streamers of glaciation is under investigation in Fraser 1975 and Boulder 1977 data. Data on optical properties of ice clouds have been obtained. Measurements of stratus cloud albedo by satellite and ground lidar and radar have been made.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0009, SUNSET METEOROLOGICAL RADAR

J.L. GREEN, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8DJ42752)

PROJECT OBJECTIVE: To operate and further develop a large VHF pulse Doppler scatter radar and other instruments at

the Sunset field site in order to measure winds, waves and turbulence in the troposphere and lower stratosphere. To analyze these measurements in terms of tides, waves, turbulent transport, etc., in order to improve the understanding of the dynamics of the atmosphere.

CURRENT YEAR PLAN: Conduct observations of the dynamics of the lower atmosphere, including: the velocity structure of the jet stream, gravity waves, mountain lee waves and turbulence. Analyze waves for energy and momentum transport and generating mechanism. Deduce turbulent diffusion coefficient from measurements of turbulence. Study radar scattering mechanism. Further develop radar for simultaneous measurements in four directions for study of spatial properties of atmospheric phenomena. Perform comparative experiments with aircraft and balloons.

PROGRESS REPORT: Analyzed observations of gravity waves in the troposphere and compared with theoretical model developed outside Program Area. Studied vertical motions and transverse circulation in vicinity of polar front. Clear-air turbulence above thunderstorms has been measured. Vertical profiles of refractivity turbulence structure constant have been measured. A model for calculation of profiles of structure constant from rawinsonde data has been developed.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0010, LAGRANGIAN CURRENT MEASUREMENTS FOR PHASE I OF NORPAX EQUATORIAL PROGRAM

D.V. HANSEN, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (R3331317)

PROJECT OBJECTIVE: To obtain Lagrangian current data in the region of the Equatorial Counter Current, for the Test Shuttle Project of the NORPAX Equatorial Program.

CURRENT YEAR PLAN: Purchase free-drifting buoys for deployment in the Equatorial Counter Current for subsequent tracking by the NIMBUS-6 satellite.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0011, CLEAR AIR TURBULENCE DETECTION

P. KUHN, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8G130512)

PROJECT OBJECTIVE: Develop, construct, install, test and calibrate an instrument on jet aircraft to provide an advance alert to jet level clear air turbulence.

CURRENT YEAR PLAN: Complete advanced infrared radiometer instrumentation construction and installation for final test and calibration.

PROGRESS REPORT: Design of instrument completed. Installation in NASA C-141 aircraft gives good correlation of subsequent CAT to prior anomalous water vapor bond response. Installation design for CV-990 and Learjet completed.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0012, RESEARCH IN AIR POLLUTION METEOROLOGY

L.E. NIEMEYER, U.S. Dept. of Commerce, Meteorology Laboratory, *Boulder, Colorado* 80302 (D7-0305; G603A-AG-01)

The research effort includes the continuing development, evaluation, and validation of air quality simulation models, both for inert and reactive pollutants. Users will be provided access to these models through the EPA User's Network for the Applied Modeling of Air Pollution (UNAMAP). New concepts and technologies will be developed and adapted for improving the weakest components of existing models, with emphasis on the effects of topography, pollutant removal and conversion processes, and complex sources. Other activities will be directed toward the determination and definition of the effects of pollutant emissions on visibility, weather, and climate. Further studies will be conducted in air pollution potential climatology.

Participation will continue in the Regional Air Pollution Study (RAPS). The field portion of the study will terminate in Spring, 1977, and analysis and use of the data for model evaluation and verification will be initiated.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0013, RESEARCH IN AIR POLLUTION METEOROLOGY

L.E. NIEMEYER, U.S. Dept. of Commerce, Meteorology Laboratory, *Boulder, Colorado* 80302 (D7-0305; G603A-AK-01)

The research effort includes the continuing development, evaluation, and validation of air quality simulation models, both for inert and reactive pollutants. Users will be provided access to these models through the EPA User's Network for the Applied Modeling of Air Pollution (UNAMAP). New concepts and technologies will be developed and adapted for improving the weakest components of existing models, with emphasis on the effects of topography, pollutant removal and conversion processes, and complex sources. Other activities will be directed toward the determination and definition of the effects of pollutant emissions on visibility, weather, and climate. Further studies will be conducted in air pollution potential climatology.

Participation will continue in the Regional Air Pollution Study (RAPS). The field portion of the study will terminate in Spring, 1977, and analysis and use of the data for model evaluation and verification will be initiated.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0014, DOPPLER RADAR DEVELOPMENT

R.G. STRAUCH, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8C370160)

PROJECT OBJECTIVE: Design, assemble, and test Doppler radar systems for use in meteorological studies. Develop methods of processing Doppler data in a form useful for meteorological analysis. The long-term goal is to develop a real-time display of velocity fields.

CURRENT YEAR PLAN: Complete pulse-pair and double-pulse processor. Complete third pulse-Doppler radar.

PROGRESS REPORT: Collected tri-Doppler data in SPACE.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0015, THEORETICAL WAVE AND TURBULENCE

J. WEINSTOCK, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8DJ40822)

PROJECT OBJECTIVE: Conduct theoretical research on waves and turbulence which occur in the earth's atmosphere and their effect on atmospheric transport. Such processes include gravity waves, mass, charge, energy transport and eddy diffusion. They greatly influence pollution dispersal and meteorological predictions.

CURRENT YEAR PLAN: 1. Deduce turbulence parameters in the lower atmosphere from Sunset Radar data. 2. Use Noxon's observations of airglow fluctuations to study dynamics in the mesosphere and thermosphere. 3. Continue comprehensive theory of turbulence in stably stratified atmospheres. 4. Determine contribution of gravity waves to atmospheric transport above 30 km. 5. Nonlinear theory of shear-flow instability. 6. Initiate study of the influence of planetary waves on transport in the stratosphere.

PROGRESS REPORT: 1. Developed theory that determines oxygen distribution and gravity wave characteristics in the lower thermosphere from fluctuations of airglow emissions. 2. Determined the contribution of turbulence to vertical transport in the stratosphere. 3. Completed work on Lagrangian theory of turbulent diffusion. 4. Completed 'three-point' method for solving problems in homogeneous turbulence. 5. Began comprehensive

theory of turbulence in a stably stratified atmosphere. Determined influence of bouyancy on vertical transport.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0016, COMPARATIVE STUDY OF IGNIMBRITES, IMPACTITES AND CHONDRITES
K. FREDRIKSSON, Smithsonian Institution, *Washington, District of Columbia* 20560 (3350-49)

Detailed petrographic, mineralogical and geochemical studies will be made on series of ash flow rocks, impactites (Gosse's Bluff, Australia and Chassenon, France) and certain chondrites. These rocks are frequently similar in gross fabric although chemically very different. The study aims towards an understanding of the 'welding' process in ash flow tuffs and impactites (both of which may be present on the lunar surface) as well as an explanation of the wide textural variations within chemically well-defined groups of chondrites.

SUPPORTED BY Smithsonian Institution, Museum of Natural History

5.0017, COMPREHENSIVE ANALYSIS OF CARBONACEOUS CHONDRITES
K. FREDRIKSSON, Smithsonian Institution, *Washington, District of Columbia* 20560 (3350-04)

Orgueil and possibly other carbonaceous meteorites will be separated chemically and mechanically. Mineralogical, chemical and organic composition of each fraction will be determined by various techniques in different laboratories. An exceptionally clean 25 gram sample of Orgueil has been obtained for this project.

SUPPORTED BY Smithsonian Institution, Museum of Natural History

5.0018, WEATHERNET
W.G. HALL, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234 (2050411)

PURPOSE: To develop criteria for site density and for automation of sensors, in a national surface network for meteorological/hydrological/climatological observations.

OBJECTIVES: In cooperation with National Weather Service (NWS) staff, NBS will use mathematical analysis techniques to relate accuracy and timeliness of forecasts (e.g., of weather and river flows), and economic benefits, to spatial density and frequency of meteorological observations. Opportunities to consolidate multi-network NWS services will be explored.

FY77 MILESTONES: (1) Quantify role of measurement in abatement of damage related to meteorological events by computer simulation using NWS's 'hydro' model for floods and water management (6/77); for cataclysmic events (hurricanes, etc.) (7/77); for temperature phenomena, e.g., frost (7-8/77). (2) Determine dependence on observation site fixity of continuity of climatological records (8/77). (3) Analyze opportunities to consolidate multi-network NWS services and observations (9/77).

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service

5.0019, HIGH-ALTITUDE ATMOSPHERIC INVESTIGATIONS
H.U. WIDDEL, Max Planck Inst. for Aeronomy, *Lindau, Federal Republic of Germany* 3411 (DA0C9409; DAERO 75 G0076)

To investigate properties and behavior of lower thermosphere, mesophere and d-region, of the ionosphere.

Develop suitable techniques, both in situ and ground-based, for measuring and studying these properties and characteristics. Rocket-borne sensors and other instrumentation will be utilized. Joint efforts between Max Planck Institute- Lindau and ASL-White Sands are basic to program. This project is relevant to ASL research program and contributes to communications, missile and artillery problems and many other Army field problems.

SUPPORTED BY U.S. Dept. of Defense, Army, Development & Readiness Command

5.0020, A STUDY OF THE DYNAMICS OF NON-SPHERICAL ATMOSPHERIC PARTICLES
I. GALLILY, Hebrew University of Jerusalem, *Jerusalem, Israel* (DA0B9429; DAERO 75 G0021)

Study the deposition of non-spherical (solid) aerosols on, and the penetration through, objects and materials.

Laboratory experiment devoted to controlled generation of nonspherical (solid) aerosols and development of methods for their size, concentration and electric charge measurements. Relevant to: cloud and fog modification; communications; laser charge transmission; Army aviation; and pollution control.

SUPPORTED BY U.S. Dept. of Defense, Army, Development & Readiness Command

5.0021, QUANTITATIVE EVALUATION OF LAND USE AND NATURAL RESOURCES IN THE RHODE RIVER WATERSHED
D. HIGMAN, Smithsonian Institution, *Edgewater, Maryland* 21037

Objectives remain as previously stated: 1. To delimit and map the sub-watersheds of tributaries to Rhode River, and to quantify the areas in each with respect to types of land use. 2. To apply Objective 1 to the years 1938, 1949, 1957, and 1972 in order to depict changes in land use throughout the Rhode River watershed between these years.

PROGRESS: The Rhode River watershed was divided topographically into 21 drainage areas, 12 of which are basins of tributaries. Images of natural color (for 1972) and black/white (for 1957) aerial photographs were projected onto the map of each sub-watershed and corrected for distortion, using a Bausch & Lomb Zoom Transfer Scope. The pattern of land use in each subwatershed was then drawn onto the map and all definable areas numbered. Sixteen types of land use or condition were defined by photo-interpretation (forest in 3 size classes, cropland, pasture/hay, other grassland, overgrown field, bare soil, residential, commercial, institutional, paved, open water, fresh marsh/swamp, salt marsh, and beach). Buildings were counted and classified as domestic, farm, and other (commercial/institutional).

STATUS IN FY 1977: The sub-watershed land use maps and associated data for the years 1957 and 1972 have been included in a mimeographed report ('Environmental Monitoring and Baseline Data, 1973, Temperate Studies, Section II') compiled under the Smithsonian Institution Environmental Sciences Program.

SUPPORTED BY Smithsonian Institution, Office of International Programs

5.0022, INCOHERENT-SCATTER STUDIES AT MILLSTONE HILL DURING THE INTERNATIONAL MAGNETOSPHERE STUDY 1976-79
J.V. EVANS, Mass. Inst. of Technology, Lincoln Laboratory, *Lexington, Massachusetts* 02173 (ATM75-22193 A01)

This grant funds the operation of the Millstone Hill incoherent-scatter radar facility to conduct measurements and analyses of physical parameters of the upper atmosphere and ionosphere. Particular investigations being pursued include: 1. Detailed measurements of the temperature and wind structure in the lower thermosphere, to better understand tidal effects and temporal variations there. 2. Work with NASA combining the Millstone Hill data with NASA satellite data to develop a more accurate model of the atmosphere above 100 km, and 3. Studies of dynamical processes in the atmosphere, including neutral winds, plasma diffusion along magnetic field lines, electric fields, and magnetic storms.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0023, STRUCTURE OF PLANETARY ATMOSPHERES
T.M. DONAHUE, Univ. of Michigan, School of Lit. Sci. & The Arts, *Ann Arbor, Michigan* 48104 (ATM75-21049 A02)

This Grant funds interdisciplinary studies aimed at the understanding of planetary atmospheres. In the context of the group involved, this definitely includes the atmosphere of the third planet, earth. The work of Dr. Donahue and colleagues will be directed toward the physical modeling which brings together and maximizes the utility of work by a number of able researchers at the University of Michigan. The past results give promise of continued success.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0024, REMOTE SENSING OF POLLUTANTS AND MINOR CONSTITUENTS IN THE STRATOSPHERE

S.R. DRAYSON, Univ. of Michigan, High Altitude Engineering Lab., *Ann Arbor, Michigan* 48104 (9-312; 04-5-158-42 MOD NO.7)

OBJECTIVE: To evaluate the solar occultation technique for determining vertical distributions of stratospheric constituents and to define the operational parameters of a satellite measurement system based on the technique. These will be compared with other techniques to describe the most effective system for monitoring purposes.

CURRENT PLANS: Based on the new inversion technique reported below, transmittance functions will be developed that are both rapid and accurate. These will be used to obtain more accurate altitude ranges and expected errors for certain constituents. A new multigas line-by-line code will be used to investigate the effects of interferences by other molecules. The use of gas-correlation techniques will also be investigated with regard to some of the less abundant constituents.

PROGRESS: 1) A new inversion method has been developed for limb sounding which is a refinement of a random search technique by Fymat. It is non-linear and converges rapidly and the computer time needed is reduced over the matrix method previously developed by the grantee. It is to be published as a doctoral thesis in late 1977. 2) Procedures have been developed for determining concentrations of CFcl3, CF2cl2 and HNO3 up to altitude of about 30 km.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0025, SPECTRAL REFLECTANCE OF SNOW-COVERED SUBSTRATES

H. OBRIEN, U.S. Army, Cold Reg. Res. & Engin. Lab., *Hanover, New Hampshire* 03755 (7-843; 7-13817)

Remote sensing of snow from aircraft and satellite radiometers is increasingly used by many snow hydrologists and climatologists. While the general spectral reflectance curve of snow has been determined (O'Brien and Munis, 1975) the effect of substrates on natural snow is not known. This effect is most pronounced when snow depth is less than 30 cm.

The objective of this project is to help define the magnitude of the substrate effect by carefully controlled in-situ photometric measurements using bandpass filters. The approach will be to collect natural snow samples on substrates such as bare soil, various rock types, ice, 'Aged' snow, asphalt, grass, etc., and to measure the spectral reflectance of the substrates covered by various depths of snow. Angles of incidence and reflection will closely resemble those commonly occurring in satellite sensors. Density, hardness, and granularity of the snow cover and relevant meteorologic data will also be collected. Bandpass filters will be centered near 0.80, 1.04, 1.10, 1.35, 1.50, and 1.80 micron as well as 0.6-0.7 and 1.55 to 1.75 micron.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0026, STUDIES OF THE ARECIBO IONOSPHERE

D.T. FARLEY, Cornell University, School of Electrical Engin., *Ithaca, New York* 14850 (ATM75-03882 A01)

This grant funds an assemblage of theoretical and experimental studies of the Earth's atmosphere using the incoherent scatter radar at the National Astromony and Ionosphere Center at Arecibo, Puerto Rico. In particular it funds research in the following areas: 1. observations of the nighttime ionospheric E-region; 2. observations of proton and oxygen ion velocities; 3. theoretical studies of photoelectron production and loss; 4. improvement of procedures for reducing and analyzing incoherent scatter data; 5. measurements of troposheric and stratospheric wind profiles; 6. two-frequency measurements of the ion-neutral collision frequency. This grant continues research pursued under NSF grant No. ATM-75-03881.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0027, NON-NUCLEAR POLLUTANTS IN STRATOSPHERIC AIR

E.P. HARDY, U.S. Energy Res. & Dev. Admin., Environmental Studies Div., *New York, New York* 10014

The objectives of this program are: to document the concentrations of selected stable tracers (particulates and gases) in the stratosphere as a function of latitude, altitude and season; to inventory the stratospheric burdens of these materials; to develop and test stratospheric transport models; and to supply basic data for other scientific programs in studying the ultimate deposition of tracers in the environment. Particulate sampling is conducted by both aircraft and balloons. Balloon-borne filtering devices are launched annually at Fairbanks, Alaska and the Panama Canal Zone, and three times a year at Alamagordo, New Mexico. Project Airstream employs the WB-57F aircraft to sample the lower stratosphere. Three missions per year are flown by the National Aeronautics and Space Administration with coverage from 75 degrees N to 10 degrees S latitude along the western coasts of North and South America. Filter samples are provided to the National Center for Atmospheric Research for measurement of particulate Cl ion, So4 ion 2, No3 ion, NH4 ion, Na ion and gaseous chlorine compounds. Freon-11 (CCl3F), sulfur hexafluoride (SF6), carbon tetrachloride (CCl4) and nitrous oxide (N2O) are measured in compressed air samples collected during aircraft missions.

RESULTS: The stratospheric concentration and inventories of CCl3F, CCl4 and SF6 have been updated through July 1975. The HASL box model of atmospheric transport confirms earlier calculations of a total atmospheric half-life of CCl3F of 18-24 years, compatible with observed atmospheric concentrations. In the 6-18 km region, mean concentrations of CCl3F, SF6 and CCl4 are 71, 0.23 and 61 pl/l, respectively.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Biomedical & Environmental Research

5.0028, CHARACTERIZATION, MEASUREMENT AND MONITORING OCEANOGRAPHIC AND ENVIRONMENTAL DATA ACQUISITION AND MONITORING SYSTEM DEVELOPMENT

D.G. DIMMLER, Brookhaven Natl. Lab., *Upton, New York* 11973 (EY-76-C-02-0016)

This project is concerned with the development of new methods, techniques and instruments concerning filtering samples, integration and averaging of parameters from sensors. Improvement of techniques and instrumentation for data communication systems which are suitable for transmission and commanding of oceanographic data from remotely located stations. Special attention is given to telemetry communication within line-of-sight and satellite communication for longer distances.

Also the application of computer techniques for purposes of experiment automation real-time data acquisition, control of experimental equipment and sensors as well as improved data verification in real-time.

Adequate techniques and devices for automated data acquisition and monitoring instrumentation systems which can be used for collection of correlated data from remotely located stations in real-time are still not generally available.

These systems are mandatory for environmental and biological studies in the coastal regions. Essential requirements for such systems are: a.) low power consumption data acquisition and monitoring stations; b.) development and implementation of valid

data sampling; c.) real-time monitoring of the experiment progress; d.) command-response telemetry connection; and e.) techniques for verification and ordering of data.

Automated systems of the above mentioned type are capable of collecting data in large quantities so that traditional techniques would become unfeasible.

RESULTS: In 1976 the main emphasis was on the development of the concepts, hardware and software of a Controllable Automated Environmental Data Acquisition System which was implemented for the Coastal Boundary Layer Transect experiment of the Coastal Shelf Transport and Diffusion project. The system was first successfully deployed in July 1975.

The system digitally integrates and stores each parameter in presently two in-situ data processors using low-power semiconductor memories until it is commanded to transmit the data to a central data collection and processing station. The central station includes a telemetry receiving station, a command transmitter and a computer system. The computer is programmed for automatic control of experimental runs. The use of low-power voltage-to-frequency converters in the data channels was extensively explored. (Text abridged.)

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Biomedical & Environmental Research

5.0029, VERTICAL DISTRIBUTION OF WIND, TEMPERATURE AND AIR QUALITY IN THE URBAN BOUNDARY LAYER

J. CHING, U.S. Environ. Protection Agcy., Environ. Sciences Res. Lab., *Durham, North Carolina* 27711 (G603A-AD-14)

OBJECTIVE: To describe and to model the temporal and spatial variability of the vertical wind and temperature profiles over an urban area and to relate these to the vertical fields of SO2 and light scattering. These studies will provide a basis for improving air quality simulation modeling.

APPROACH: Data from eight RAPS (Regional Air Pollution Study) intensive boundary layer field studies obtained by instrumented helicopter and mobile van, by a LIDAR and an acoustic sounder, from fixed-wing aircrafts and from the RAMS surface and upper air network will be subjected to in-depth analyses on the spatial and temporal behavior of the mixed layer and associated air quality fields as a function of land use and season.

PROGRESS: 75 percent of helicopter/mobile van data has been processed.

CURRENT PLANS: Remaining helicopter data will be processed along with LIDAR, acoustic sounder and fixed-wing aircraft data. Mixed layer depths derived for these periods will be made available. Further analyses will include: 1. Intercomparison of the mixed layer depths observed using LIDAR, radiosondes, SODAR and helicopter soundings. 2. Statistics of the morning and evening transition period, i.e., the rate of rise strength, duration and onset of the inversion over St. Louis for different seasons and land uses. 3. Tests of current inversion rise parameterization formulas against the observations in the St. Louis urban/rural areas. 4. Case studies of the urban heat island.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0030, RESISTANCE LAWS OF THE URBAN PLANETARY BOUNDARY LAYER

J. CHING, U.S. Environ. Protection Agcy., Environ. Sciences Res. Lab., *Durham, North Carolina* 27711 (G603A-AD-03)

OBJECTIVE: To derive the stability functions for calculating the fluxes of momentum and heat using large and mesoscale flow parameters in the St. Louis metropolitan area. The computed values of the momentum, heat fluxes and roughness length values determined from RAPS (Regional Air Pollution Study) special field study periods will be used along with the radiosonde, pibal data and LIDAR information to determine the stability functions for estimating heat and momentum fluxes. These results will be compared against results of other studies conducted over much less complex surface conditions.

PROGRESS: The turbulence data from four (4) 30 meter towers are being processed. LIDAR, radiosonde and pibal data are presently available.

CURRENT PLANS: The depth of the mixed layer and the average wind within the mixed layer, geostrophic wind, horizontal temperature gradients, momentum and heat fluxes and roughness and stability lengths will be calculated from the various data sets gathered as part of the RAPS boundary layer intensive field study. Extensive analyses will be conducted to determine the stability function from this data set.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0031, MCMURDO VOLCANIC PROVINCE, ANTARCTICA - SURVEILLANCE OF MT. EREBUS, AND GEOLOGICAL MAPPING OF MT. MORNING

P.R. KYLE, Ohio State University, Inst. of Polar Studies, *Columbus, Ohio* 43210 (DPP76-23440)

The Ohio State University will initiate a program of surveillance and geological research on Mt. Erebus, Antarctica. Mt. Erebus is an active volcano, that has had a lava pool in the inner crater for the last several years. It is unique in that it is the only active volcano of its petrographic type in the world. The principal investigator, Dr. Philip Kyle, has been monitoring the eruptive pattern of Mt. Erebus for the past five years, prior to becoming a member of the Ohio State University staff. This project will continue and enlarge on his earlier research on Mt. Erebus. Research on the crater area of Mt. Erebus will include geologic mapping, geophysics, remote sensing, and laboratory analyses of samples. Geological and paleomagnetic research will also be done on related, but older, volcanos in the McMurdo volcanic zone. Results will contribute to an understanding of the geologic and tectonic history of the McMurdo area during post-mid-Cenozoic time.

Two Ohio State University scientists will do research in Antarctica during the 1977-78 field season.

SUPPORTED BY U.S. National Science Foundation, Div. of Polar Programs

5.0032, SPECTROSCOPIC MEASUREMENTS OF OZONE, WATER VAPOR, AND OTHER ATMOSPHERIC GASES

K.N. RAO, Ohio State University, School of Math. & Phys. Scis., *Columbus, Ohio* 43210 (9-114; 04-4-158-30 MOD. NO. 6)

OBJECTIVE: To improve the accuracy of spectroscopic parameters used in atmospheric transmittance calculations necessary for the retrieval of vertical temperature profiles from the spectral radiance data obtained by satellite sounding instruments. The accuracy of existing values of the spectral line parameters have been demonstrated to be inadequate to meet the quantitative requirements of the sounding program.

APPROACH: The spectral absorption of lines and/or bands of ozone, carbon dioxide and water vapor will be measured in the laboratory in those spectral regions which affect the measurement channels of the sounding instruments. Spectroscopic parameters--line position, line strength and width--will be deduced by existing methods.

For ozone, spectral absorption will be measured at high resolution (approximately equal to .03) cm-1) in the nu2 and nu3 bands and an attempt will be made to perform measurements in the nu1 band.

Measurements will be made on the 4.3 micron and 15 micron CO2 bands. After an initial band mapping, emphasis will be on deducing band strength and on parameters of those lines amenable to measurement. The spectral absorption of water vapor and water vapor-nitrogen mixtures will be measured to determine the effect of line wings and the continuum in the 11 micron atmospheric window.

PROGRESS: The nu2 and nu3 bands of ozone have been measured and interpreted. Line strengths have not yet been measured. The nu2 fundamental plus combination bands of 12C 16O 16O, 12C 16O 17O, 12C 16O 18O, 13C 16O 16O, 13c 16O 17O, 13c 16O 18O 4.3 micron region have been measured and interpreted. Line intensities of selected lines in the R branch are being measured.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0033, ATMOSPHERIC TURBULENCE AND DIFFUSION RESEARCH

F.A. GIFFORD, U.S. Dept. of Commerce, Air Reso. Atm. Turb. Dif. Lab., *Oak Ridge, Tennessee* 37830

The purpose of the program is to conduct basic research studies of atmospheric turbulence and diffusion and to provide a continuing meteorological service to the ERDA and its contractors in the Oak Ridge Operations area. Basic research includes atmospheric diffusion studies, planetary boundary layer studies, numerical studies of turbulent flows and turbulent heat flux, and momentum transfer studies. Meterological instrument research is conducted as required to verify and improve the estimates made in connection with the above services and studies.

RESULTS: 1. Air trajectories over eastern Tennessee region were computed using data obtained in the ETTEX experiment of 1974. The ORNL-ATDL air transport model was used to assess sulfur transport from large point sources, lead deposition near highways, and radon concentrations from mine tailings. Eddy diffusivity parameterizations of turbulent atmospheric mixing were conducted with the one-dimensional planetary boundary layer model. Work was begun on the solution of potential flow over complex terrain by both finite-difference and finite-element techniques. 2. A one-dimensional cooling tower plume and cloud growth model was developed and tested against field data. Models of drift deposition from cooling towers were compared. Possible effects of moisture flux on atmospheric stability were studied using Bowen ratio estimates from the field data. A prototype of an auto-pilot-equipped drone aircraft to study the mixing layer was constructed. 3. A Monte Carlo diffusion technique was developed, using ETTEX data to estimate the required velocity fluctuation cross-products. A model for plume rise terminated by convective turbulence was derived. Asymptotic forms for plume dispersion coefficients were suggested, and turbulent diffusion typing schemes were reviewed. A wind tunnel for small-scale studies in a simulated atmospheric surface layer and a water flow table were procured. 4. A summary of the distribution of solar radiation in a deciduous forest was completed. Instrumentation of a new forest meteorology field site was begun. 5. A research-grade solar radiation monitoring station was designed and the requisite instruments purchased. This station will contribute to the NOAA-wide observing network.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Biomedical & Environmental Research

5.0034, INTERNATIONAL SOUTHERN OCEAN STUDY - ISOS- SOUTHERN OCEAN THERMAL STRUCTURE FROM SHIPS OF OPPORTUNITY

W.J. EMERY, Texas A & M University System, Graduate School, *College Station, Texas* 77843 (OCE76-81371 A01)

This project is part of the International Southern Ocean Studies (ISOS). The long-range goal of ISOS is to understand the dynamics of the Antarctic Circumpolar Current.

This project provides for observations of upper ocean thermal structure from supply ships traveling between Australia and Antarctica during the austral summer of 1976/77. These ships would also make meteorological observations including sea surface temperature and salinity. These data will be combined with satellite information and with oceanographic data from the Soviet research ship Professor Zubov. The combined data set will be used to study the spatial and temporal structure of the Antarctic Circumpolar Current and the Polar Front in the region south of Australia.

SUPPORTED BY U.S. National Science Foundation, Div. of Ocean Sciences

5.0035, UPPER ATMOSPHERIC STUDIES USING COMBINED INCOHERENT SCATTER, PHOTOMETRIC, AND SATELLITE-BORNE MEASUREMENTS

H.C. CARLSON, Univ. of Texas, Center for Space Sciences, *Richardson, Texas* 75082 (ATM76-80208)

This grant funds a theoretical and experimental study of the ionosphere in three main areas: ionospheric heating experiments, F-region electron energy balance, and thermospheric dynamics. These studies will use data taken at the National Astronomy and Ionosphere Center at Arecibo, Puerto Rico, together with theoretical work in both plasma physics and molecular kinetics.

Particular problems to be addressed include: 1. a determination of the cooling rate of thermal electrons to atomic oxygen, 2. a direct measurement of the effective lifetime of O(1D), the O(1D) quenching coefficient, and the O(1D) excitation efficiency, 3. a measurement of the temperature dependence of the O2 e reaction, 4. a study of the processes by which the HF heating facility at Arecibo produces fluxes of superthermal electrons, and 5. a study of the observed nighttime thermospheric bulge that is currently not explained by existing models.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0036, MEASUREMENT OF TROPOSPHERIC AND STRATOSPHERIC TRACE GASES BY GAS CHROMATOGRAPHY

D.R. CRONN, Washington State University, School of Engineering, *Pullman, Washington* 99163 (R804033-03; G603A-AI-04)

The objective is to make measurements of the vertical concentration distributions of selected trace gas species in the troposphere and lower stratosphere. Emphasis will be placed on determinations of halocarbons and non-methane hydrocarbons. Determination of the concentrations of the halocarbon species will be accomplished by the methods of electron capture - gas chromatography and gas chromatography-mass spectrometry -while gas chromatography with flame ionization detection will be employed for the determination of the hydrocarbons. Samples will be collected by aircraft flights in the United States.

SUPPORTED BY U.S. Environmental Protection Agency, Office of Research & Development, Environmental Sciences Research Lab.

5.0037, A STUDY OF THE SPATIAL AND TEMPORAL VARIATION OF TEMPERATURE IN THE ATMOSPHERIC BOUNDARY LAYER 11586-GS

J.A. BUSINGER, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (DA0D9198; DAHC04-74-G-0022)

To extend the knowledge of boundary layer turbulent transport processes through a study involving both experimental and theoretical investigations. Better understanding of the structure of turbulence in the layer of air near the ground is important in the prediction of transport, diffusion and concentration of gasses and aerosols, and in the improvement of optical systems. Such systems have diverse military applications ranging from detection and tracking to remote sensing of properties of the earth and atmosphere.

The field research involves use of a computer-controlled real time data collection and analysis system for measurement of the time and spatial variation of temperature fluctuations, atmospheric stability, heat and momentum fluxes of surfaces of roughness. The theoretical research involves analyses of the temperature data to verify and improve techniques for indirectly obtaining stability, heat and momentum fluxes exclusively from the temperature statistics and gross meteorological parameters over as wide a stability range as possible.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

5.0038, THE CYCLES PROJECT

P.V. HOBBS, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (8C350377)

CURRENT YEAR PLAN: Structure of the storms over the Pacific Ocean will be investigated using simultaneous measurements from synchronous satellites, aircraft, radars, rawinsondes, and a ground-based network. In particular, modifications of rainbands as they move onshore, the air motions within rainbands, the structure, air motions and precipitation mechanisms in the stratiform clouds associated with cyclonic storms both over the ocean and the land, and the role of generating cells in cyclonic storms will be investigated.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0039, LIDAR MEASUREMENT OF BOUNDARY LAYER WINDS AND CONVECTIVE STRUCTURE 13535-GS
J.A. WEINMAN, Univ. of Wisconsin, School of Letters & Science, *Madison, Wisconsin* 53706 (DA0E9033; DAAG29 76 G0156)

To study convective structure and remotely determine winds in the planetary boundary layer under a variety of meteorological conditions, and compare lidar-derived winds with conventional derived winds. Real-time wind measurements and investigation of convective structure of the lower atmosphere are needed to support (1) the wind correction for atmospheric general-purpose rockets under development and older systems in operation; (2) the transport and diffusion research at Dugway Proving Ground; (3) aircraft landings and takeoff; and (4) the forecast of local weather conditions.

Simultaneous atmospheric measurements using high spatial and temporal resolution monostatic lidar, a miniature radiosonde, and acoustic sounder, and an 86 meter tower instrumented to measure sensible heat and momentum fluxes. Obtain lidar wind under a variety of meteorological conditions and study convective structure revealed by aerosol density inhomogeneities.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, MEDICALLY SIGNIFICANT PROBLEMS OF VOICE COMMUNICATION SYSTEMS
R.T. CAMP, U.S. Army, Bioacoustics Division, *Ozark, Alabama* 36362 (DA0B6887)

The acoustic environments associated with military training and operations in Army helicopters and tanks are usually hazardous and may cause interference with effective voice communications and the detection of warning signals. Most of the present aviation communication systems have characteristics that introduce both frequency and amplitude distortion of the speech signals.

This research will be directed toward the development of an improved noise-cancelling microphone for use in Army aircraft. Improved radio communication systems will be developed for Army aircraft and armor vehicles (e.g., MICV). New communication devices such as contact microphones will be evaluated for their potential use in Army systems.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Aeromedical Research Lab.

6.0002, OPERATIONAL MEASURES OF IN-FLIGHT PERFORMANCE (22)
K.A. KIMBALL, U.S. Army, Aviation Psychology Division, *Ozark, Alabama* 36360 (DA0E6730)

To explore, in the operational environment, variables which affect aviator performance.

The approach will involve the utilization of an in-flight monitoring and recording system capable of sampling and recording nineteen channels of continuous analog and digital information, and an oculomotor monitoring device for eye movement recording during flight. Areas of research to be addressed will include: aviator oculomotor performance during conditions of VFR, IFR, low-level and terrain flight, assessments of workload of pilot and copilot/navigator during terrain flight, and navigation performance during terrain flight day and night conditions.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Aeromedical Research Lab.

6.0003, MEDICAL RESEARCH OF OPERATIONAL PROBLEMS IN ARMY AVIATION
F.S. PETTYJOHN, U.S. Army, Aviation Medicine Res. Div., *Ozark, Alabama* 36360 (DA0B6894)

To provide the US Army information and recommendation for protection of aviator health from medical hazards encountered in operational Army aviation.

To apply accepted medical research methods in Army aviation to fulfill the above objective.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Aeromedical Research Lab.

6.0004, AERONAUTICAL TECHNOLOGY, TECHNICAL AREA M - AVIATION HUMAN ENGINEERING
I.C. STATLER, U.S. Army, Air Mobility Res. & Dev. Lab., *Moffett Field, California* 94035 (DA0D5001)

Improve Army air mobility systems by providing improved knowledge, criteria and technology for man-machine integration and by providing better engineering methods for performing the AVSCOM man-machine integration functions.

Systematic exploratory R&D in human performance technology, flight simulation methods and requirements, control and display technology, and man-machine dynamics. The approach emphasizes analytical and experimental studies using laboratory, simulation, mathematical modeling and flight test facilities. These activiteis have been coordinated with and will complement and support the handling qualities R&D of technical area A and the flight simulator development of technical area K. Objectives will be achieved largely through joint participation with NASA, making maximum use of the facilities and expertise available within NASA for man-machine systems research.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

6.0005, IDENTIFICATION FRIEND OR FOE
J.A. BARNES, U.S. Army, Human Engineering Labs., *Aberdeen Proving Ground, Maryland* 21005 (DA0C4965)

To determine the ability of the US Army pilot/gunner to identify military vehicles as friend or foe. To devise an efficacious method of testing US Army pilot/gunners that will give results equivalent to those obtained when actual vehicles are used in realistic settings.

The objectives of the FY 77 Identification Friend or Foe program are: (a) to determine how long it takes an AH-1 pilot/gunner assigned to an operational US Army unit to identify an array of moving military vehicles as friend or foe when operating from an altitude above the ground of 6 meters and at a slant range of 1500 meters, both with and without the aid of a magnifying optical sight; (b) to determine at what slant range an AH-1 pilot/gunner assigned to an operational US Army unit can identify an array of moving vehicles as friend or foe when operating at an altitude above the ground of 6 meters, both with and without the aid of a magnifying optical sight; (c) to repeat these tests using high-fidelity moving pictures of the original tests taken from the pilot/gunner's position; (d) to repeat these tests using scale terrain and vehicles to recreate the original tests.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Human Engineering Lab.

6.0006, APPLICATION OF HUMAN BODY MODELS
I. KALEPS, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF323100)

Sophisticated computer-based biodynamic models having a capability to predict in great detail both internal and external response of the human body resulting from high-level mechanical stress exposures have been developed. The present effort seeks to modify and refine these model formulations to optimize applicability to Air Force and flight operations oriented problems, to develop comprehensive graphic display capability to facilitate interpretation of analytically predicted results and to carry out

model validations using experimental data obtained from separately conducted experimental programs at the Biodynamics and Bionics Division of the Aerospace Medical Research Laboratory and at other institutions.

This effort will emphasize the application of the head-spine model and the articulated total body (ATB) model to problems related to exposures of the head-spine system to high stresses and human extremity excursions during wholebody accelerations, respectively. These models will be refined to accommodate complex restraint system properties, including rate-dependent force effects, define appropriate interactions with the environment corresponding to high mechanical stress flight operation conditions and allow use of broad anthropometric data bases for study of responses of various percentile subjects. Graphic displays of various degrees of sophistication will be developed and generated in hard-copy form, CRT display or directly on film for time-sequenced examination. Parameter sets corresponding to selected experiments will be compiled and used for computer input for simulation of the particular experiments. Comparison of actual experimental results with predicted model output will be used as a basis of model validation and/or modification.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch Lab BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0007, MEASUREMENT AND DETECTION OF AMINE-BASED ROCKET FUELS

L.J. LUSKUS, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF320860)

This effort provides detection concepts and prototype instrumentation/methodology for monitoring extremely hazardous and toxic amine-based rocket propellants. Development of area detectors, personal dosimeters and other monitoring devices is urgently needed for handling, transfer and sampling of amine fuels such as hydrazine, MMH and UDMH. The requirement exists both in rocket testing and missile maintenance to provide maximum lead time for donning of protective garments, and to insure a continuous record of occupational exposure. This work supports AFRPL-TN-2109-74-01. Previous accomplishments in the area of hydrazine fuel instrument/methodology development are documented under work unit 71641614. This work unit is established to implement a new technology planning objective as directed by HQ Aerospace Medical Division.

Electrochemical and chemiluminescence instrumentation will be developed and evaluated for use as area and confirmation monitors. Personal dosimeters will be developed contractually with final evaluation and testing accomplished under this work unit.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0008, CONTACT LENSES AND KERATOCONUS

T.J. TREDICI, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF323030)

The objective of this work unit is to evaluate and follow selected usaf aircrew personnel with visual disorders, principally corneal, requiring contact lenses to maintain their visual function. Particular emphasis will be placed on those individuals with irregular astigmatism and keratoconus. This work unit will also include a group of individuals who prior to entering flying training had refractive errors altered by a technique known as orthokeratology. A small number of patients who underwent this form of 'treatment' and who appear to be developing a corneal dystrophy (keratoconus) have now been identified. The possibility has to be explored that this may have been hastened or caused by the orthokeratology procedure. The permanence of this procedure (alteration of the refractive error) has been questioned and therefore follow-up examinations might better help in answering these questions.

Patients to be included in this study will be identified primarily from referrals to the Aeromedical Consultation Service from base-level Flight Surgeon's offices Air Force-wide and to a lesser extent from MAJCOM and HQ USAF referral. Referral will usually be based on the fact that the patient cannot be corrected to 20/20 visual acuity with spectacle lenses. The scope of each evaluation will be dictated by those elements indicated from the patient's condition. Extensive baseline data from the initial evaluation will be used in assessing changes in ocular status over time. Each follow-up examination will result in a new recommendation regarding fitness for continued flying duty. Work on this unit was formerly conducted under 7755-09-04.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine NG, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0009, OPTIMAL SINGLE LEAD EXERCISE ELECTROCARDIOGRAPHIC LEAD SYSTEM FOR IMMEDIATE RISK FUNCTION EVALUATION IN THE FIELD

R. WOLTHUIS, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF321630)

At the present time exercise stress testing is conducted in a non-standardized fashion throughout the Air Force and, as a result, many of the stress tests are uninterpretable. This effort will define an optimal single-lead electrocardiographic lead system which has a high degree of sensitivity and specificity for detecting coronary disease in the aircrewmember for use during dynamic stress testing and at the same time can be used Air Force-wide with little expenditure of resources or skill.

Multiple leads will be recorded during exercise stress testing of aircrewmembers for measurements utilizing automated ECG analyses. These measurements will be compared to the results of the clinical evaluations including coronary arteriography and the cardiopulmonary responses to stress testing. Various dynamic stress tests will be utilized to establish a single lead system that has applicability to the various forms of stress testing available throughout the AF. This work was formerly documented under 7755-01-05.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine NG, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense, Air Force

6.0010, NIGHT OPERATIONS METHODOLOGY

H. OZKAPTAN, U.S. Army, Org. & Systems Research Lab., *Alexandria, Virginia* 22333 (DA0B9893)

(1) To determine critical perceptions and alternative procedures for successful performance under conditions of attenuated, marginal and stressful visual and other environments; (2) to develop visual aids and techniques to enhance visual perception at night; (3) to develop navigation techniques to aid the combat infantryman, and the helicopter pilot at NOE altitudes.

(1) A laboratory facility which simulates features of nighttime environments will be utilized. (2) Factors critical to performance in low-light environments will be identified in field and laboratory experiments where the number of variables affecting performance will be limited and controlled so that critical factors can be isolated. (3) Performance of military personnel will be evaluated in a number of perceptual and monitoring tasks. Experimental data will include measures of target identification accuracy, obstacle avoidance and navigation.

SUPPORTED BY U.S. Dept. of Defense, Office of the Deputy Chief of Staff for Personnel, Org. & Systems Research Lab.

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, MATHEMATICS OF OPERATIONS RESEARCH 12414-M

R.M. THRALL, Rice University, Graduate School, *Houston, Texas* 77001 (DA0E8950; DAAG29 76 G0305)

To investigate the following areas of mathematics of operations research: 1. Integer programming, 2. Stability properties of

certain solution concepts for n-person games, 3. Measurement of effectiveness and benefit/cost analysis, 4. Stochastic and nonlinear programming. The proposed research on the measurement of effectiveness and benefit/cost analysis would be useful to systems management such as air traffic management systems and communications systems. New and improved techniques in integer programming will have applications to several Army problems, e.g., personnel management (DCSPER).

Use of cutting plane methods and development of stopping rules in integer programming; generalization of value concepts in games; development of effectiveness indices.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, RADIOLOGICAL PHYSICS

A. CHATTERJEE, Univ. of California, Lawrence Berkeley Laboratory, *Berkeley, California* 94720

The objective underlying the proposed research is concerned with a quantitative evaluation of the physical and chemical stages associated with the interaction of energetic heavy particles with living organisms. It is well known that the chemical stage of interaction follows the physical stage of energy deposition (track structure) but preceeds the biological stages in radiation interaction. It is also known that sometimes the chemical stage can be modified by external reagents. It is hoped that the proposed research will be helpful not only in the understanding of basic mechanism and modeling of radiation effects but will also help radiation therapists. The activities in the proposed research will include both theoretical approach and experimental approach. Experiments will be done mostly on the radiolytic decomposition of water and hence measurement of the radical formation. Theoretical models will be developed in relation to biological effects. An important aspect of the project will be to have a constant feedback from experimental results to theoretical modeling.

RESULTS: For various atomic number particles we have measured the ferric yield using Fricke dosimeter system. We have also correlated the measured ferric yields to track structure effects. It also appears that the model in progress has the required flexibility to be applicable in the interpretation of physical, chemical and biological phenomena.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Biomedical & Environmental Research

8.0002, HIGH RYDBERG COLLISION STUDIES

R.M. HILL, S R I International, *Menlo Park, California* 94025 (PHY76-24541)

A program is proposed for the study of properties of atoms in highly excited (Rydberg) states. Experiments would probe the interactions of these atoms with other atoms and molecules. Included are ionizing reactions of Rydberg atoms and electrons, and the use of Rydberg atoms to obtain electron scattering data at very low energies.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0003, TWO PHOTON EXCITATION AND COLLISIONAL PROCESSES IN MOLECULAR HYDROGEN

C.K. RHODES, S R I International, *Menlo Park, California* 94025 (PHY77-01849)

An experimental program examining two-quantum excitation and collisional processes in H2 is proposed. This technique of excitation overcomes the traditional problems associated with selective population of excited electronic levels of that system, and can also be used for many other simple molecules and atoms. Excited state densities of between 10 to the 13th power cm-3 and 10 to the 14th power cm-3 of the H2 (E, F1, g ion) state are estimated, a value sufficiently large to enable direct measurement of several collisional phenomena, including rotational and vibrational relaxation, electronic energy transfer, para-ortho conversion, four-center reactions, triplet production, and possibly excited state/excited state processes. Experiments of this type would involve the first selective excitation of a gerade excited state of H2. Photoionization from the E, F1, g ion state should also be observable enabling a direct determination of that cross section. Similar experiments can also be performed on HD and D2, permitting an analysis of the isotopic character of these states and collisional processes. Measurements of this nature provide an excellent basis for comparison with theoretical treatments of scattering and reaction in simple molecular systems.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0004, RESONANCE AND RELATED STUDIES IN CONDENSED MAGNETIC SYSTEMS

V. JACCARINO, Univ. of California, School of Letters & Science, *Santa Barbara, California* 93106 (DMR77-20185)

Resonance and related techniques will be used to study new problems at high temperatures (e.g., effects of fast relaxing impurities on the molten state EPR) and to embark on a systematic investigation of the magnetic dilution problem. The latter will involve temperature and concentration dependent studies of the variation of the antiferromagnetic-spin flop phase boundary, the parallel and perpendicular susceptibility, antiferromagnetic resonance (AFMR) linewidth, the parallel pumping threshold, the Mn55 NMR linewidth, the ordering temperature and the exchange enhancement of the paramagnetic susceptibility in the system Mn1-xZnxF2. Further work on the magnetic polaritons and the localized mode problem in the far infrared will be carried out along with complementary impurity NMR studies. This work should bring a level of understanding to the dilute and mixed system problems comparable to that which exists for the perfect magnetic materials.

This is a continuation of research supported under DMR7503847; first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0005, THEORETICAL PARTICLE PHYSICS AND THEORY OF PHASE TRANSITIONS

M. NAUENBERG, Univ. of California, Graduate School, *Santa Cruz, California* 95060 (PHY76-18598 A01)

Research in field theory and statistical mechanics initiated under NSF grant PHY74-05906 AO2 will continue. Renormalization group and lattice techniques will be applied to solve basic problems in phase transitions and in the Reggeon field theory. Semi-classical soliton structures in the non-Abelian gauge theory of quark interactions will also be studied. In particle physics, this research will seek to elucidate the Pomeron (no-quark) exchange mechanism, as well as to explore several areas in strong and weak interaction phenomenology.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0006, ULTRA-LOW-TEMPERATURE STUDIES OF LIQUID AND SOLID HELIUM

E.D. ADAMS, State University of Fla. Sys., School of Arts & Sciences, *Gainesville, Florida* 32601 (DMR77-12259)

Equipment will be purchased for the development of a nuclear demagnetization apparatus for experiments at ultra-low temperature. Items include a high field superconducting solenoid, data acquisition equipment, and temperature devices. The apparatus will be used to study the properties of quantum solids and fluids below 0.020 Kelvin.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0007, FUNDAMENTAL RADIATION PHYSICS AND CHEMISTRY

M. INOKUTI, Argonne National Laboratory, *Argonne, Illinois* 60439

Thorough elucidation of the action of ionizing radiation on any molecular substance, and hence on biological cells, must include detailed characterization of all primary processes, i.e, individual inelastic collisions of energetic particles (including photons) with molecules. Using methods of theoretical physics, we study those aspects of the primary processes and closely related phenomena which we consider most strategic and urgent. Specific subjects of current study include 1) the spectral distribution of the optical and generalized oscillator strengths of atoms and molecules, 2) systematics of many atomic properties, 3) applications of the multiple-scattering model to photoionization and electron collisions of molecules, 4) spectral properties of stripped atomic ions, especially their systematics and relativistic effects, 5) theory of electron degradation and of the yields of the primary species generated under irradiation, and 6) development of the R-matrix method for slow-electron-scattering by heavy atoms and for two-electron escape phenomena.

RESULTS: Item 3) has produced results on photoionization of N2, CO, HX, and X2 (where X equals F, C1, or Br) and on electron-N2 scattering. All results show novel molecular effects in collisional properties. On item 4), pronounced relativistic effects are found in transition probabilities in highly stripped ions. Item 5) has recently seen considerable progress both in basic theory and in specific applications.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Biomedical & Environmental Research

8.0008, DEVELOPMENT OF IMPROVED MONITORING EQUIPMENT FOR ON-LINE DETECTION AND CHARACTERIZATION OF AIRBORNE PLUTONIUM AEROSOLS

T.J. YULE, Argonne National Laboratory, *Argonne, Illinois* 60439

The objective of this program is to develop: 1) on-line airborne plutonium monitors with improved sensitivity and reliability over those that are presently available, and 2) techniques for determining activity and particle-size distributions of aerosols containing plutonium. The monitors are intended for use in the operational areas of facilities at which the possibility of airborne releases exist. Improved sensitivity and reliability will be achieved by improving the discrimination against natural background alpha activity by utilizing improved mechanical and electronic separation schemes. Prototypical monitors will be constructed and tested under controlled laboratory conditions and in the field. New techniques will be developed and existing techniques evaluated for determining the activity and aerodynamic particle-size distributions of plutonium aerosols. Solid-state track recorders will be used to determine the amount of plutonium in individual particles collected on filters and on stages of samplers that separate an aerosol according to aerodynamic particle size. The characteristics of some representative plutonium aerosols will be determined.

RESULTS: An on-line monitor consisting of a single-stage impactor to separate the larger-sized airborne plutonium particles from the smaller-sized dust particles--which contain the background activity--was constructed and tested. The tests indicated that improved operational characteristics require a two-stage system; such a system has been designed. The feasibility of using track recorders to determine the amount of fissionable material in individual particles collected on a filter has been demonstrated.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Biomedical & Environmental Research

8.0009, A COMPUTER CONTROL AND DATA ACQUISITION SYSTEM FOR SOLID-STATE AND ATOMIC PHYSICS RESEARCH LABORATORIES

L.L. CHASE, Indiana University, School of Arts & Sciences, *Bloomington, Indiana* 47401 (DMR77-10547)

An on-line acquisition and computer control system will be set up for several experimental research programs in solid-state and atomic physics at Indiana University. The equipment will enhance the productivity and cost efficiency of five research programs, four of which are funded by DMR.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0010, THEORETICAL PARTICLE PHYSICS

A.W. HENDRY, Indiana University, Res. Division, *Bloomington, Indiana* 47401 (EY-76-S-02-2009, Task B)

The program we propose for the coming year consists of studies involving particle collisions, meson spectra in quark models and topics in gauge theory. We wish to examine the consequences of the high mass, high spin resonances found in our recent analysis of pion-nucleon scattering, especially their implications for quark excitation schemes. We also plan to study the 9.5 GeV mass region where recently observed structure suggests the existence of a fifth quark. In addition, we intend to examine topics related to exotic mesons, as well as several problems concerning gauge theory on a lattice. Our collaboration with experimentalists at Indiana (Task A) and at Argonne is expected to continue.

RESULTS: We have completed an extensive partial wave analysis of pion-nucleon scattering up to 10 GeV/c revealing many new high-spin baryon resonances. We have also examined a one-gluon-exchange potential with linear confinement to study meson spectra with particular attention to recently found structure at 3.772 GeV and 9.5 GeV. In addition, we have succeeded in deriving several rigorous results for Wilson's lattice gauge theory.

Part 2 of 2.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of High Energy & Nuclear Physics

8.0011, MACROSCOPIC DESCRIPTION OF LASER MATTER

I.R. SENITZKY, Israel Inst. of Technology, *Haifa, Israel* (DA0C9358; DAERO75G0012)

To develop a macroscopic, classical description for a collection of multilevel atomic systems which takes into account all the levels, or frequencies (radiative and nonradiative), pertinent to laser operation. Such a description will facilitate laser analysis, design, and, possibly, improvement.

The research approach is based on the well-founded assumption that a multilevel system can be treated as multilevel 'angular momentum' oscillators and that, consequently, a collection of the multilevel systems can be described by the 'vector addition' of the angular momentum oscillators. The macroscopic behavior of a system of multilevel molecules is then obtained by taking the limit of large total angular momentum number.

SUPPORTED BY U.S. Dept. of Defense, Army, Development & Readiness Command

8.0012. CHEMISTRY OF ELECTRONICALLY EXCITED STATES OF ATOMS, DIATOMIC MOLECULES AND DIATOMIC IONS 12197

D. SETSER, Kansas State University, School of Arts & Sciences, *Manhattan, Kansas* 66506 (DA0E8980; DAHC04-75-G-0018)

To study the chemistry of electronically excited states of atoms, diatomic molecules, and diatomic ions. The proposed research should yield kinetic information such as energy transfer rates and vibrational relaxation data on electronically excited states of atoms, molecules, and ions. These results will have direct application in the evaluation of the potential of proposal laser systems. Potential for long-range usage of the results lies in the Army's upper atomspheric research program.

Spectroscopic analysis of experiments on species including n sub 2 (A(3)sigma u (plus), CO (a(3) pi), O sub 2 (plus) (A), and CO(plus) (A(2)pi) will be conducted in a flowing afterglow apparatus. These studies will yield determinations of energy transfer rate constants, insight into the mechanism for vibrational relaxation, identification of product states, and thermochemical and spectroscopic data.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

8.0013, SOME PROBLEMS IN THEORETICAL PHYSICS
T. FULTON, Johns Hopkins University, Graduate School, *Baltimore, Maryland* 21218 (PHY76-23469 A01)

Research will be carried out in the physics of the new particles, the Bethe-Salpeter equation, relativistic atoms and Quantum Electrodynamics, electromagnetic and weak interactions of nuclei and various aspects of field theory.

This work represents a continuation of that currently supported by Foundation grant PHY75-01052 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0014, LYMAN-ALPHA SOURCES FOR PLASMA STUDIES
D.W. KOOPMAN, Univ. of Maryland, Inst. for Fluid Dyn. & Math., *College Park, Maryland* 20742 (ENG75-02618 A01)

This program will continue research directed toward investigating the properties of coherent ultraviolet light sources obtained by frequency conversion of ruby and other long-wavelength sources. Emphasis will be placed on conversion mechanisms based on frequency-tripling and two-photon resonant mixing in rare gases. The work will be directed first to the generation of Lyman-alpha radiation (1215 A) using tripling of a dye laser source in krypton. This will be followed by an investigation of two-photon resonance in rare gases to achieve improved conversion efficiency.

This is a continuation of research previously supported under NSF grant ENG-7502618.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

8.0015, RELATIVISTIC DIODES IN CROSSED MAGNETIC FIELDS
G. BEKEFI, Mass. Inst. of Technology, Electronics Research Lab., *Cambridge, Massachusetts* 02139 (EY-76-S-02-2766)

The purpose of this program is the study of the dynamics of charge particle motions in relativistic diodes subjected to a transverse magnetic field. To date we have concentrated our investigation on cylindrical diodes acted upon by externally generated magnetic fields. The parapotential flow was unstable, as evidenced by copious microwave emission. During the coming year we propose to investigate the particle dynamics in pinched diodes in which the magnetic field is self-generated by the electron flow. Pinching will be initiated by laser generation of anode blow-off plasma. Microwave emission will be used as a diagnostic of instabilities.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Laser Fusion

8.0016, MAGNETIC ORDERING AND NEUTRON PHYSICS STUDIES
C.G. SHULL, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (DMR77-24307)

Fundamental neutron physics studies are to be carried out following the testing of various neutron interferometer systems. Studies on the magnetization (as seen in Bragg diffraction) in dilute alloys of nonmagnetic impurities will be continued. Magnetic spin correlations in rare-earth containing permanent magnets, small-angle disorder scattering and the structure of liquid alloys will be investigated.

This is a continuation of research supported under DMR7203068 and the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0017, ABSORPTION OF CO2 LASER RADIATION IN DENSE PLASMAS
D.R. BACH, Univ. of Michigan, School of Engineering, *Ann Arbor, Michigan* 48106 (ENG76-20279)

The main objective of this research program is to study nonlinear interaction phenomena which arise when the radiation from a high-intensity CO2 laser beam interacts with a dense plasma. The interaction phenomena to be studied are closely related to mechanisms that are important in the coupling of laser light to pellet materials. Experiments will be carried out with a Lumonics Model 60l oscillator using a small, high-density Z-pinch plasma which has electron densities that exceed the critical density for CO2 radiation. The work includes a study of the Stimulated Brillouin scattering from the Z-pinch, a study of the scattering of Ruby laser light from the plasma in order to detect the onset of acoustic oscillations, a measurement of the transmission of CO2 light through the Z-pinch as a function of the incident intensity, and calculations involving all of these experiments.

This is a continuation of research previously supported under NSF grant ENG-7414366.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

8.0018, HIGH-RESOLUTION PROFILING AS A MEANS OF STUDYING FUNDAMENTAL PARAMETERS IN THE INDUCTIVELY COUPLED PLASMA
S.R. KOIRTYOHANN, Univ. of Missouri, School of Arts & Sciences, *Columbia, Missouri* 65201 (CHE77-22915)

Dr. Koirtyohann is studying emissions from the various regions of the inductively-coupled plasma (ICP) to understand some of the fundamental parameters involved in its operation. Although this plasma is rapidly becoming an important and analytically useful spectroscopic source, very little is known about its mechanism of operation or about the reactions undergone by analyte or sample matrix in the various regions of the plasma. Detailed profiling of atomic, ionic, and molecular emissions of the ICP will allow the full analytical potential of this source to be realized and many pitfalls in methods of development to be avoided.

Dr. Koirtyohann is using an improved method for source profiling recently developed in his laboratory which consists of a photo-diode array placed vertically near the exist slit of a stigmatic monochromator to produce a profile at a given wavelength for a complete horizontal or vertical section of the source. The resolution is better than 0.1 mm and the measurement can be made in a matter of minutes.

This profiling method is being used to study zones of intense emission, atomization and ionization processes, and distributions of temperature, analyte, and electron density within the plasma.

SUPPORTED BY U.S. National Science Foundation, Div. of Chemistry

8.0019, THEORETICAL STUDIES OF THE ELECTRON STRUCTURE OF SOLID SURFACES
J.C. HERMANSON, Montana State University, School of Letters & Sciences, *Bozeman, Montana* 59715 (DMR77-11862)

A theoretical model will be developed to examine the electronic structure of solid surfaces. The technique to be used will be an extension of the resolvent method which has been modified to treat a tight-binding model of solid surfaces. This method will be used to compute densities of states for the interpretation of the results of angle-resolved photoemission experiments on oriented single crystals. The initial aim of this work is to consider clean surfaces of solids, but a later objective will be the calculation of chemisorption behavior. This approach utilizes the best available band structure information and emphasizes the role of geometrical factors in determining surface quantum structure. Relaxation and reconstruction will be treated by modifying atomic interactions near the surface.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0020, INELASTIC PROCESSES IN ATOMIC COLLISIONS

M.E. RUDD, Univ. of Nebraska, School of Arts & Sciences, *Lincoln, Nebraska* 68508 (PHY76-23348 A01)

A broad program of basic experimental atomic collisions measurements will be continued which involves ion-atom, atom-atom, and electron-atom collisions with specific emphasis in the following areas: A) Measurement of cross sections for the production of electrons and slow positive ions in collisions of ions, neutral atoms, and electrons with gaseous targets. B) Polarized photon-scattered atom/ion correlation measurements in He ion plus He and H ion plus Xe collisions will be extended. C) Measurement of the decay of negative-ion resonances will be continued by examining structure in the optical channel for various levels in N and He. Beam foil experiments will investigate the effect of a tilted foil in producing anisotropy in the excited atoms. An analysis of the polarization of the emitted radiation will allow conclusions concerning the alignment and orientation of the source atoms.

This work is a continuation of that currently supported under grant PHY73-04777 A02.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0021, GRAVITATION, RELATIVITY AND COSMOLOGY

D.T. WILKINSON, Princeton University, Graduate School, *Princeton, New Jersey* 08540 (PHY76-82662 A01)

Theoretical and experimental research on gravitation, relativity, and cosmology initiated under NSF grant PHY71-03266 A04 will be continued.

The experimental group will apply novel instrumental and analytical techniques to obtain data from the celestial laboratory. Theoretical research will explore mathematical aspects of classical and quantum gravitation theory. Topics to be investigated include: Experimental--(1) Improved determination of the isotropy of the microwave background radiation using newly developed ground-based and balloon-borne radiometers. (2) Study of galaxies in the far red to search for primeval galaxies and the systematic properties of elliptical galaxies. (3) Analysis of clustering of galaxies to uncover information on their creation and evolution. (4) Measurement of the cosmic light intensity from unresolved extragalactic sources to provide constraints on the theory of evolution of galaxies in the early universe and the presence of unknown sources.

Theoretical--(1) Study of Constrained Hamiltonian systems to provide a framework for a wide variety of physical systems. (2) Canonical quantization of gravitation and other gauge fields and its consequences on ideas of causality and gravitational collapse.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0022, III-V HETEROJUNCTION STRUCTURES FOR LONG WAVELENGTH INJECTION LASERS (DARPA AO 3137)

C. NUESE, Radio Corporation of America, *Princeton, New Jersey* 08540 (DA0D3115; DAAB07-76-C-0872)

To develop efficient injection lasers operating at room temperature (300 degree Kelvin) and emitting any desired wavelength in the 0.9-1.7 micron spectral range.

Heterojeunction structures of III-V ternary alloys, such as gallium indium arsenside and gallium indium phosphide will be grown by vapor epitaxy method. These structures will be evaluated by advanced metallurgical and electrical methods. Heterojunction injection lasers will be fabricated, either of the 'large-optical cavity' type or as double heterojunctions, their performance evaluated, and growth techniques optimized for high-quality, room-temperature performance.

SUPPORTED BY U.S. Dept. of Defense, Electronics Command, Night Vision Lab.

8.0023, ADVANCED TECHNIQUES IN ATOMIC PHYSICS

H. METCALF, State University of New York, School of Arts & Sciences, *Stony Brook, New York* 11790 (PHY75-13147 A01)

Support is provided for experiments in various states of progress. The first is a study of the phenomenon of coherence narrowing using the temporal resolution available with pulsed lasers. It is expected to elucidate several aspects of this phenomenon using pulsed, tunable dye lasers to excite atoms in vapors of various densities and using fast photodetectors to observe the fluorescence. The second major experiment is a precision measurement of the fine structure in n equals 3 helium. This also uses the time resolution available from the pulsed laser. Because observations are restricted to atoms which have been in their excited states for a predetermined period of time, interference effects are observed which enable much higher precision of measurement. The third major experiment is a measure of the Lamb Shift in doubly ionized lithium.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0024, THEORY OF HEAVY-ION COLLISIONS

D. SPERBER, Rensselaer Polytechnic Inst., School of Science, *Troy, New York* 12181 (EY-76-S-02-3463)

The purpose of the proposed work is to theoretically investigate the mechanism of colliding heavy ion. Both fusion and strongly damped collision are to be investigated. Both fusion studies will be directed so as to extract information about the ion-ion potential. The analysis of strongly damped collision will be performed so as to extract information about (1) ion-ion potential, (2) the dissipative forces, (3) the role of collective excitation in heavy ion collisions and (4) the understanding of the mechanism of nucleon transfer in heavy ion collisions. The above calculations are classical. Quantum calculation will be performed to determine the validity of the classical limit.

RESULTS: Classical and semi-classical models for the analysis of fusion and strongly damped collisions have been developed. The models account very well for the data. Collective degrees of freedom have been included in a phenomenological way. The model has been generalized to include transfer as a random process.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of High Energy & Nuclear Physics

8.0025, STUDY OF THE STRUCTURE OF LIGHT NUCLEI WITH NEUTRONS

R.O. LANE, Ohio University, School of Arts & Sciences, *Athens, Ohio* 45701 (EY-76-S-02-2490)

The structure of light nuclei will be studied by means of their interaction with neutrons. The experimental program will include the elastic and inelastic scattering for neutrons interacting with 6Li, 7Li, 10B, 11B, 12C and 13C measured at the Ohio University Tandem Accelerator Laboratory by use of sub-nanosecond pulsed beams and time-of-flight methods. These results will be analyzed via the R-matrix formalism for comparison to theoretical model predictions. This research will enable us to improve our knowledge of the structure of light nuclei and develop further the various theoretical models for nuclear structure and nuclear reactions. These nuclei have particularly important applications in fusion reactor programs as well as in the standards used for measurement of cross sections and neutron fluxes.

RESULTS: A large set of data has been measured for the elastic and some inelastic scattering cross sections for neutrons scattered from 6Li, 7Li, 10B, 11B and 12C between 4 MeV and 8 MeV for angles from 20 degrees to 160 degrees using the Ohio University Tandem Accelerator. An R-matrix calculation has extracted several properties for the compound nuclei.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Basic Energy Sciences

8.0026, MOSSBAUER STUDIES OF SURFACE MAGNETISM

R.W. HOFFMAN, Case Western Reserve Univ., Graduate School, *Cleveland, Ohio* 44106 (DMR77-10640)

Mossbauer Effect emission spectroscopy will be carried out in an ultrahigh vacuum and low-temperature environment to

determine the surface magnetic field and its orientation for a number of ferromagnetic crystals. A radioactive Mossbauer source will be deposited in submonolayer quantities on ferromagnetic single crystals surfaces at low temperature to restrict and maintain atomic layer depth-resolution and to prevent clumping. The surface structures and degree of contamination before and after deposition of the cobalt isotope will be determined by in-situ low-energy electron diffraction and Auger electron spectroscopy. After periods of two to thirty hours, the amount of surface contaminants will again be examined. The (lll) nickel surface will be examined first, followed by other simple Ni surfaces. These studies will include iron and other ferromagnetic crystals. The effects of surface charge transfer will be looked for in the isomer shift.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0027, THERMODYNAMICS AND STATISTICAL MECHANICS OF PHASE TRANSITIONS
R.B. GRIFFITHS, Carnegie Mellon University, Mellon Institute of Science, *Pittsburgh, Pennsylvania* 15213 (DMR76-23071 A02)

Research in the thermodynamics and statistical mechanics of phase transitions, previously supported under NSF grant DMR73-02419 A01, will be continued. The proposed research will be concerned with phase transitions and critical points in liquid mixtures; higher order critical points in liquid mixtures; an experimental search for a special tricritical point in a five-component mixture; the theory of phase transitions in gases adsorbed on a graphite substrate; and some renormalization-group calculations associated with these problems. Experiments concerned with the dynamics of nucleation in metastable liquids near their critical points will also be performed.

This is the first year of a 2-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0028, ATOMIC COLLISIONS AND PLASMA PHYSICS 11166-P
M.A. BIONDI, Univ. of Pittsburgh, School of Arts & Sciences, *Pittsburgh, Pennsylvania* 15260 (DA0D9068; DAAG29 76 G0343)

To advance the understanding of ion-electron recombination rates of atmospheric species, atmospheric ion-molecule reaction rates and mechanism of electron-ion recombination. This research is directly relevant to the ballistic missile defense work at BRL, and has the potential for contributing parameters for studies of laser propagation in the atmosphere.

Research will consist of: (a) measurements of electron-ion recombination rates under conditions duplicating the normal and artificially perturbed ionosphere, (b) measurements of ion-molecule reaction rates which affect the identities and concentrations of positive and negative ions in the various ionospheric regions, again for normal and perturbed conditions, and (c) studies of the basic mechanisms of electron capture by positive ions to provide improved understanding of basic processes, guidance for theoretical calculations, and new measurement techniques.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Army Research Office

8.0029, MINORITY CARRIER INJECTION INTO MATERIALS CONTAINING TRAPS
H.K. HENISCH, Penn. State University, School of Science, *University Park, Pennsylvania* 16802 (DMR76-80619)

Experiments will be conducted on the voltage-current characteristics of metal-semiconductor and semiconductor-semiconductor contacts in two distinct operational regimes as regards trapping of injected minority carriers. The two regimes will be established by varying (a) the ambient temperature, and (b) the trap concentration, the latter through neutron bombardment and/or heat shock. Recently published theoretical treatments lead to the conclusion that trapping should play a major role in determining the voltage-current relationship in the forward direction, so much so that resistance increases have been predicted as a result of injection when the trap density is high enough. There are indications (from the published and unpublished results of other workers) that this is indeed the case, and the present project is intended as a designed experimental test under ideal conditions. Though effects related to surface states and effects related to bulk trapping cannot be unambiguously resolved by the measurement of a single voltage-current relationship, there should be no difficulty in resolving them by comparative experiments under distinctly different trapping probabilities, and by the in situ introduction of traps into a completed system. Germanium will receive principal attention, though it is also planned to perform comparative measurements on other single-crystal semiconductors.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0030, THE GROWTH AND APPLICATION OF CADMIUM TELLURIDE
R.H. WILLIAMS, New University of Ulster, School of Physical Sciences, *Coleraine, Republic of Ireland* (DA0D9305; DAERO 77 G0026)

To grow and characterize large cadmium telluride crystals for possible application as an infrared window, gamma-ray detector, and near-infrared photodetector.

Large single crystals of the II-VI compound semiconductor CdTe will be grown by pulling from the melt, using a high-pressure crystal puller. Crystals will be characterized optically and electrically. In particular the surface properties of the crystals, the nature of metallic contacts to them and the nature of space charge layers near their surfaces will be investigated in order to establish the influence of surface and interface effects on CdTe-based devices. Attempts will be made to fabricate p-n junctions by diffusion of metals from the surface with the view to assessing CdTe as a device material.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Research & Standardization Group

8.0031, FORMAL AND COMPUTATIONAL STUDIES IN THE QUANTUM THEORY OF MOLECULAR DYNAMICS
D.J. KOURI, Univ. of Houston, School of Arts & Sciences, *Houston, Texas* 77004 (CHE76-18970 A01)

Both inelastic and reactive molecular collisions will be studied. Studies of inelastic scattering processes will continue using rotating frame approaches, especially the new statistical-jz conserving approximation. Special attention will be given to the physical bases of the approximation, extensions to new systems, treatment of differential cross sections and molecule-molecule systems, and predictions of transitions. Studies of collisions involving H2 plus H2, H2 plus HCl, Li ion plus H2 and Ar plus CO2 will be made using the original jz method.

In the study of reactive scattering, the new approximate optical potential of Lin and Kouri will be applied to K plus CH3I, KI plus CH3, and the F plus H2 reactions. The new K-operator formalism will be applied to a simple model for breakup.

This work is a continuation of that currently supported by Foundation Grant, MPS-7413719.

SUPPORTED BY U.S. National Science Foundation, Div. of Chemistry

8.0032, INTERATOMIC FORCES IN SOLID AND LIQUID TRANSITION METALS
N.H. MARCH, Univ. of London, School of Science & Technology, *London, England, United Kingdom* (DA0C9488; DAERO 76 G0071)

Undertake research to calculate interatomic forces in transition metals and their alloys. These forces in these materials are not well understood and yet they hold significant potential in a variety of applications such as hydrogen absorption and permanent magnetic materials.

This work is to be specifically concerned with transition metals and their alloys, both in solid and liquid phases. Recent

progress in electronic band structure on pure transition metals is to be used to study interatomic forces in solid phases. In the liquid phase the route of checking potentials derived by the self-consistent method of Schofield, Hutchinson and colleagues by molecular dynamics will be followed. A second route, via partial structure factors in the liquid, will also be explored for a - b transition metal alloys. If potentials can be extracted, they will be used to study the short-range ordering in the solid by computer simulation. The phase diagrams of a - b alloys, particularly the liquids and solids curves for alloys in which size differences are small, will be examined.

SUPPORTED BY U.S. Dept. of Defense, Development & Readiness Command, Research & Standardization Group

8.0033, RADIATION PHYSICS
L.H. TOBUREN, Battelle Memorial Institute, *Richland, Washington* 99352 (EY-76-C-06-1830)

The radiation physics program is concerned with basic mechanisms by which ionizing radiation deposits energy to matter and the subsequent transport and degradation of the energy. Measurements of differential cross sections for electron emission in proton and helium ion collisions with atomic and molecular gas targets form the basic study of energy deposition. Charged particle energies of interest range from 5 keV to 4 MeV. Studies emphasize the effect of molecular structure on the energy and angular distribution of electrons set free in the media by these charged particle irradiations. Phenomenological models of these differential ionization cross sections are being developed which serve as input data to Monte Carlo calculations of track structure. The energy density distributions derived from track structure calculations provide the initial conditions required for theoretical investigation of energy transfer in condensed systems. A strong theoretical effort in the study of energy transport is then coupled with time-resolved studies of optical emission from binary liquid systems in order to investigate the fundamental processes of energy transfer and the formation of early chemical species by ionizing radiation.

RESULTS: Electron emission cross sections for numerous simple molecules containing atoms and molecular bonds representative of biological material have been measured for 0.3 to 2.0 MeV proton impact. Work has been initiated to extend these measurements to 5 to 50 keV protons and to heavier ions. These cross sections have been used to derive scaling parameters amenable to phenomenological modeling for use in Monte Carlo track structure calculations. Proton-induced radioluminescence in liquids was used to investigate energy transfer processes on a nanosecond time scale and theoretical progress has been made in relating these studies to initial energy deposition events.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Biomedical & Environmental Research

8.0034, LOCAL ELECTRONIC PROPERTIES OF SEMICONDUCTOR SURFACES AND INTERFACES
M.G. LAGALLY, Univ. of Wisconsin, School of Engineering, *Madison, Wisconsin* 53706 (EG-77-S-02-4435)

An improved understanding of the physical and chemical properties of semiconductor surfaces and interfaces is a prerequisite to the development of semiconductor devices for the production and conversion of energy. In particular, the electronic properties of such surfaces will be important in determining their applicability to a given process. The local electronic properties of surfaces and interfaces of some elemental and compound semiconductors will be studied, using a combination of ultraviolet photoemission and Auger electron spectroscopy. Valence band AES measurements will be made for the chemisorption of C1 and O on Si and compared to existing UPS results to study transition probability and relaxation effects in AES for adsorption systems. The surfaces of a series of orthorhombic IV-VI compounds useful is possible future solar cell materials, and local electronic properties in the system B/SiO2/Si, important in Si device technology, will be investigated with a combination of electron spectroscopies and LEED.

SUPPORTED BY U.S. Energy Research & Development Admin., Div. of Basic Energy Sciences

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, THEORETICAL STUDIES OF INTERPLANETARY MAGNETIC FIELDS, TURBULENCE AND COSMIC RAYS
E.H. LEVY, Univ. of Arizona, School of Liberal Arts, *Tucson, Arizona* 85721 (ATM76-17058 A01)

A significant part of the sun's influence on the earth and the planets is exerted through the intermediary of the solar wind. In addition, our general ideas about the behavior of astrophysical plasmas can be directly tested only in interplanetary space. For these reasons solar-wind studies have relevance over wide areas of science.

The grant continues support for theoretical studies of a range of basic solar-wind properties and behaviors. In this continuing program, the investigations undertaken will include the effects of turbulence influctuations on measured radial variations of, for example, solar-wind density, the interplanetary magnetic field and the density of cosmic rays. Also the large-scale morphology of the interplanetary magnetic field will be studied, with particular emphasis given to the effect of the field's structure on cosmic-ray propagation and anisotropies. Scintillations in the flux of astronomical radio waves are produced by turbulence and fluctuations in the solar-wind. This has opened an avenue for ground-based studies of solar-wind variations. Since the theory of these scintillations is still incomplete, research into the causes of radio scintillations will be undertaken.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0002, STUDIES OF WHITE DWARF STARS
P.A. STRITTMATTER, Univ. of Arizona, School of Liberal Arts, *Tucson, Arizona* 85721 (AST76-22263 A01)

This research will be concerned with an investigation of the origin and properties of the white dwarf stars, one of the possible end points of stellar evolution. Projects to be carried out include determinations of the space density of cool white dwarf stars, spectroscopic studies of cool white dwarf stars, and determinations of the nature of certain peculiar cool stellar objects. There will be analyses of the atmospheres of some of these stars in order to determine their physical properties and understand the physical processes that affect their evolution. Theoretical and observational studies will be made of the evolution of white dwarf stars in binary systems.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0003, INFRARED SPECTROSCOPY OF YOUNG STARS AND PROTOSTELLAR OBJECTS
R.I. THOMPSON, Univ. of Arizona, School of Liberal Arts, *Tucson, Arizona* 85721 (AST77-20369)

The research to be carried out will be an investigation of the physics of the early stages of stellar evolution. The principal observational method will be the use of the Steward Observatory Fourier Transform Spectrometer to obtain one to five micron medium resolution spectra of young stars and protostellar objects. The observations will be supplemented by spectroscopy at optical wavelengths with currently existing spectrometers. The spectral data will form the basis for a theoretical investigation of the physical conditions which may lead to the onset of star formation. Special attention will be paid to the role of the occurrence of viscous disks during the late stages of star formation and the early stages of stellar evolution.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0004, OBSERVATIONAL STUDIES OF PRE-MAIN-SEQUENCE STELLAR EVOLUTION
L.V. KUHI, Univ. of California, School of Letters & Science, *Berkeley, California* 94720 (AST77-19896)

This research will be directed towards the determination of the general properties of pre-main-sequence stars (T Tauri stars and related objects) by making use of optical, infrared and radio data. Optical scanner and infrared broadband measurements will be used so that a comparison with theoretical evolutionary tracks can be made. There will be infrared and radio observations of the circumstellar envelopes surrounding these stars in order to obtain information on the nature of the dust and gas in these envelopes.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0005, SOLAR RADIATION PROGRAM
G. LERFALD, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (BAA21239)

PROJECT OBJECTIVE: Provide a unique data set to improve solar radiation models. The effect of aerosols and clouds on solar radiation will be examined and a model proposed. Extensive analysis of data to be performed.

CURRENT YEAR PLAN: Phase III will apply lidar, radiometric, acoustic sounder and spectral radiation monitoring equipment at three east coast sites and at Boulder, Colorado. The data will be used to determine cloud and aerosol effects on solar radiation, particularly effects on the direct and diffuse components.

PROGRESS REPORT: Data were collected at Boulder, Colorado, Colstrip, Montana, and Fairplay, Colorado. Preliminary analysis have been performed. Computer programs to efficiently process and analyze the data have been developed.

SUPPORTED BY U.S. Energy Research & Development Admin., Unspecified Unit

10.0006, OBSERVATIONAL STUDIES BEARING ON STELLAR EVOLUTION
R.D. MCCLURE, Yale University, School of Science, *New Haven, Connecticut* 06520 (AST76-22672 A01)

The research to be carried out is aimed at improving the observational data bearing on the ages and element abundances of stars and star clusters. These data will provide a better understanding of the chemical history of the Galaxy and nearby external galaxies, as well as improve our understanding of stellar evolution. Projects to be carried out this year include observations of stellar evolution. This will include photoelectric observations of the clusters NGC 6819, NGC 2204, Mel 66, and M55. Image tube spectroscopy will also be carried out on selected stars, especially in the globular cluster M55, in order to study abundance anomalies. Work will be carried out to determine the abundances of heavy elements in late-type giant stars. The observations of old stellar systems combined with data on stars in the general field of the solar neighborhood will provide information bearing on models of the formation of the halo disk of the Milky Way Galaxy.

This is a continuation of work previously supported under NSF grant AST76-22672.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0007, COORDINATED OBSERVATIONS OF LOWER THERMOSPHERICAL CIRCULATION
R.G. ROPER, Georgia Inst. of Technology, School of Aerospace Engin., *Atlanta, Georgia* 30332 (ATM76-81558)

This grant funds coordinated observations of lower thermospheric circulation being carried out by a global network of meteor wind facilities and incoherent scatter radars. It also funds the collation, interpretation and publication of the results as they pertain to global neutral atmosphere motions in the height range 80 to 120 kilometers, with due regard being given to interaction with the lower and higher atmosphere.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0008, STUDIES OF SOLAR AND MAGNETOSPHERIC PARTICLES
S.M. KRIMIGIS, Johns Hopkins University, Applied Physics Laboratory, *Laurel, Maryland* 20810 (ATM76-81099)

This grant is for scientific studies of data on charged particle intensities, angular distributions, energy spectra, and compositions obtained with the Charged Particle Measurement Experiment built by The Johns Hopkins University Applied Physics Laboratory and carried aboard the NASA satellites IMP-7 and 8. Similar data from JHU/APL experiment on IMP-6 will be examined in conjunction with that from IMP-7 and 8. Data from other experiments on the same spacecraft will also be used on a cooperative basis with other investigators.

In general terms, the objectives of this study are to obtain new information and understanding of the electrodynamics and plasma physics of the terrestrial magnetosphere, interplanetary medium and the Sun. The specific studies will concern themselves with two areas: (a) The study of particle acceleration phenomena in the earth's magnetotail, with emphasis on plasma sheet and neutral sheet measurements of particle pitch angle distribution, charge, and energy spectra. Particular emphasis will be devoted to analysis of events from two or more closely spaced spacecraft. (b) A statistical and case-by-case study of the charge composition of solar particle emissions, particularly during active periods, and delineation of the dependence of composition on energy, flux level, location on the solar disk, spatial structure in the interplanetary medium, and interaction with the earth's magnetosphere.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0009, INTERFEROMETRIC OPTICAL SPECTROSCOPY OF THE INTERSTELLAR MEDIUM
N.P. CARLETON, Smithsonian Institution, *Cambridge, Massachusetts* 02138 (310-4050-03)

In addition to work described by Dr. W.A. Traub, we have completed analysis of data on the detection of interstellar lithium in the S Ophiuchi cloud, showing that lithium is present, but depleted from its general cosmic abundance value, as are other metals in the gaseous component of that cloud.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0010, THEORETICAL ASTROPHYSICS
A. DALGARNO, Smithsonian Institution, *Cambridge, Massachusetts* 02138 (3IT-4T50-01)

Computation programs have been developed for constructing models of the basic atomic and molecular processes in the creation, generation, and dissipation of energy. This theoretical research will help establish the parameters for study of terrestrial, stellar and planetary atmospheres, as well as the interstellar and intergalactic mediums.

Detailed calculations were performed of the ultraviolet fluorescent pumping mechanism for populating the rotational levels of molecular hydrogen and used to construct models of interstellar clouds. Quantitative studies of chemical schemes for the formation of interstellar molecules were continued. The efficiency of the main cooling process in diffuse clouds containing molecular hydrogen was calculated.

Theoretical investigations of a wide range of atomic and molecular processes of atmospheric and astrophysical interest were carried out.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0011, THE GALACTIC DISTRIBUTION OF INTERSTELLAR ABSORPTION
R.J. DAVIS, Smithsonian Institution, *Cambridge, Massachusetts* 02138 (310-4050-05)

OBJECTIVE: Obtain an improved determination of the galactic distribution of interstellar dust, and of variations in its extinction properties, in the wavelength range 1300 to 6000 angstroms.

SECONDARY OBJECTIVE: To complete the identification of stars having peculiar photometric properties in the above wavelength range, based on UBV, H-beta, and the Celescope ultraviolet photometry.

APPROACH: Obtain UBV and H-beta photometry for all stars in the Celescope catalog not already having UBV photometry, using telescopes and photometric equipment at Kitt Peak National Observatory (Davis) and at Cerro Tololo Inter-American Observatory (Deutschman and Schild). Determine variations in the interstellar extinction as a function of distance and galactic longitude and latitude for all stars in the Celescope catalog.

PROGRESS: Observations, data reduction, and preliminary data analysis are complete. We are preparing a paper for publication, most probably in the Astrophysical Journal Supplement Series.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0012, STUDIES OF THE ATMOSPHERIC STRUCTURE OF PECULIAR EARLY-TYPE STARS

J.B. LESTER, Smithsonian Institution, *Cambridge*, *Massachusetts* 02138 (310-4050-09)

OBJECTIVE: Certain hot stars have spectral absorption lines which are either stronger or weaker than the majority of stars of the same spectral type. The conditions which produce these anomalous line strengths are largely unknown. The object of this work is to study representative peculiar stars in an attempt to determine these conditions. The conditions probably contain information about the atmospheric structures of evolving stars.

APPROACH: The approach is to make high-dispersion spectral observations of the program stars and to interpret these observations with model stellar atmosphere calculations.

PROGRESS: A number of stars have been observed with the Cassegrain echelle spectrograph at the Mt. Hopkins Observatory. Measurement of this material is being delayed pending the completion of modifications to the David Mann microphotometer.

FUTURE: Additional observations of more stars and observations of different spectral regions will be made during the coming year.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0013, RADIO ASTRONOMY - SPECTRAL LINES

A.E. LILLEY, Smithsonian Institution, *Cambridge*, *Massachusetts* 02138

Study of the nature of complex molecules in interstellar space continues. Research includes searches for new molecules with emphasis on supporting laboratory measurements, which permit accurate wavelength determinations. In addition, molecules already discovered in space will be surveyed for their distribution in space. The study of the radiation from the molecules in several excitation states to attempt to understand the causes of the molecular radio radiation is also planned.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0014, 1. STUDIES OF COMET MOTIONS - 2. IAU AND CBAT SUBSCRIPTIONS

B. MARSDEN, Smithsonian Institution, *Cambridge*, *Massachusetts* 02138

Computer time to continue studies of non-gravitational forces on comets and to pursue the scientific side of the affairs of the Central Telegram Bureau. Computer time and administration of Bureau.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0015, ASTROMETRIC OBSERVATIONS OF COMETS AND ASTEROIDS AND SUBSEQUENT ORBITAL INVESTIGATIONS

R. MCCROSKY, Smithsonian Institution, *Cambridge*, *Massachusetts* 02138 (NGR 09-015-212; 163663-31P)

Perform ground-based astrometric observations of comets, asteroids and planets of particular interest to NASA.

Evaluate field plate reduction as compared to use of usual astrographic catalogs.

Will perform orbital computations and examine 'nongravitational' anomalies of comets.

Astrometric observations of objects fainter than m equals 15 are photographed with the 61' reflector of the George R. Agassiz Station of the Harvard College Observatory.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0016, NUCLEAR ASTROPHYSICS

H. MITLER, Smithsonian Institution, *Cambridge*, *Massachusetts* 02138 (31P-4P50-03)

Work on electron-ion screening in dense thermonuclear plasmas has been completed. Calculations have been made showing differences from standard expressions. The work has been extended to include dynamical effects, and this is being written up for publication.

Expressions are being worked out for the H and He cosmic-ray spectra.

Most of the current effort lies in elaborating a new theory of formation of the Moon via partial capture from a protomoon, so as to exclude its iron.

Investigations on the origin of the neutron fluxes for the s and r processes are proposed.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0017, MICROWAVE SPECTROSCOPY

H.E. RADFORD, Smithsonian Institution, *Cambridge*, *Massachusetts* 02138 (31R-4R50-01)

Laboratory measurements of microwave and far-infrared spectral lines of interstellar molecules are done by resonance absorption methods.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0018, THE STRUCTURE AND EVOLUTIONARY STATUS OF BE STARS

R.E. SCHILD, Smithsonian Institution, *Cambridge*, *Massachusetts* 02138 (310-4050-11)

OBJECTIVE: Be stars are in a stage of evolution during which a disk of gas forms around the star, the disk manifesting itself in hydrogen emission lines. A quantitative study of the conditions in this envelope and in the atmosphere of the star provides information about the evolution of hot stars.

APPROACH: Observations of energy distributions and spectral line strengths have been made for several Be stars. These data will be combined with model computations of the envelope to derive quantitative values of the temperature, density and state of ionization.

PROGRESS: The energy distributions and line strengths have been measured. The model computations have been initiated, and the detailed comparison with the data will begin shortly.

FUTURE: Additional stars will be observed to extend the results found here.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0019, PETROLOGICAL AND MINERALOGICAL STUDIES

J. WOOD, Smithsonian Institution, *Cambridge*, *Massachusetts* 02138 (31P-4P50-02)

Comprehensive studies are made of solid extraterrestrial material including returned lunar soil samples and meteorites by techniques of mineralogy and petrology; optical microscopy, X-ray diffraction, electron-probe microanalysis and scanning electron microscopy. Petrological studies lead to deductions about the origin and evolution of these materials.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0020, STUDIES OF PECULIAR STELLAR SPECTRA
A.P. COWLEY, Univ. of Michigan, School of Lit. Sci. & The Arts, *Ann Arbor, Michigan* 48104 (AST75-20351 A02)

This research will be directed towards: 1. an investigation of the various stages of stellar evolution and 2. the study of the interactions of close companion stars and their effects on the evolution of the stellar system. The observational data will be obtained primarily at the National Observatories (Kitt Peak in Tucson and Cerro Tololo in Chile) and at the Dominion Astrophysical Observatory in Canada.

Special emphasis will be given to the investigation of stellar systems which are strong X-ray emitters. These systems are believed to be in a very late phase of their evolution with one of the components usually a neutron star or highly condensed object. The spectroscopic investigation of these systems will aid in the determination of the physical properties (mass, radius, composition) of highly evolved stars. Effects of mass exchange and transfer between the component stars will be studied. There will be studies on binary systems which do not emit strong X-rays. A comparison of these different types of systems will help in our understanding of stellar evolution.

This is a continuation of research previously supported by NSF Grant AST75-20351 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0021, GALACTIC AND EXTRAGALACTIC ASTROPHYSICS
N.A. BAHCALL, Princeton University, Graduate School, *Princeton, New Jersey* 08540 (AST76-15386 A01)

The main thrusts of the research to be carried out are: 1) Observational determination of the structure, contents and properties of rich clusters of galaxies and their possible application to cosmological models; 2) Detailed optical studies of X-ray sources including unidentified high galactic latitude sources, rich clusters of galaxies, and globular star clusters.

The first is important for the understanding of the dynamics and formation of clusters of galaxies, which are the largest easily studied units in the universe. The observations may be useful in determining the angular-size-versus-distance relation and thus new observational constraints on the cosmological deceleration parameter, which formally describes the large-scale structure of the universe. The second study consists of identifying and understanding the nature of the new objects currently being discovered by satellites which are observing the extremely interesting X-ray sources.

This is a continuation of grant AST 76-15386 for 13 months duration.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0022, GALACTIC AND EXTRAGALACTIC RESEARCH WITH THE IMPROVED BURRELL SCHMIDT-TYPE TELESCOPE
P. PESCH, Case Western Reserve Univ., Graduate School, *Cleveland, Ohio* 44106 (AST77-23063)

A variety of astronomy research projects will be undertaken by the staff of the Warner and Swasey Observatory. The projects will include studies of faint nearby stars, luminous stars in the Milky Way Galaxy, and Quasars. The common theme of the projects is the unique capability of a Schmidt telescope equipped with objective-prisms to do faint spectroscopy and surveys of astronomical objects.

One of the new projects is a low-dispersion (1000 A/mm at 6500A survey of the northern sky in the red region of the spectrum. This survey, to update one last done in the early 1940's at very low resolution, will identify nearby M-type dwarfs, Sulfur and Carbon-Sulfur stars, and objects that emit the Hydrogen-alpha lines of the spectrum.

Another new project is a color-independent survey in the northern sky for bright, high-redshift, radio-quiet, quasi-stellar objects (QSO's). Malcolm Smith at Cerro Tololo Inter-American Observatory has shown that a low-dispersion objective-prism can be used to discover high-redshift QSO's independent of color and/or radio characteristics. A survey of this nature is being done by others in the southern hemisphere; a similar survey in the northern sky will be initiated. This is the only known method of obtaining an accurate and unbiased sample of these cosmologically important objects. The continuing projects will include an effort aimed at identification of objects listed in the Air Force Infrared Sky Survey Catalogue. The photoelectric photometry of faint M stars in the direction of both the north and the south galactic poles will be obtained for purposes of determining correctly the space of dwarf M stars. Objective-prism spectral classification of parallax stars, studies of the Magellanic Clouds, and an investigation of radial velocities of stars obtained from Schmidt telescope objective-prism plates will be carried out. This is a continuation of research done under NSF grant AST 75-17853 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

GENERAL

11.0001, AERO ENGINES IN MUSEUMS AROUND THE WORLD
R.B. MEYER, Smithsonian Institution, *Washington, District of Columbia* 20560

This is a list of 1,200 air-breathing engines (mostly piston gasoline and turbojets) in museums around the world.

It has been printed from punched cards and distributed to 100 supporting museums.

The additional information needed to produce a second and more complete edition is being collected. It is to be published in the summer of 1978.

SUPPORTED BY Smithsonian Institution, National Air & Space Museum

11.0002, RESTORATION OF THE P-51B EXCALIBUR
R.C. MIKESH, Smithsonian Institution, *Washington, District of Columbia* 20560

This will be one of a series of monographs on the history and restoration of aircraft in the NASM Collection.

The manuscript is complete and it will be submitted for publication in March 1978.

SUPPORTED BY Smithsonian Institution, National Air & Space Museum

11.0003, AERONAUTICAL HISTORY SOURCE GUIDE
E.T. WOOLDRIDGE, Smithsonian Institution, *Washington, District of Columbia* 20560

The goal of the project is the completion of an Aeronautical History Source Guide. The guide material will probably be stored in the S.I. computer with access through the NASM Library. A summary of the material will be published if it is not too voluminous.

Questionnaires have been sent to more than 1500 aviation-related organizations. Their responses will be analyzed, collated and organized. Many organizations will have to be required for clarification and additional information. This project will continue through FY'79.

SUPPORTED BY Smithsonian Institution, National Air & Space Museum

American Institute of
Aeronautics and Astronautics

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Two New Films

America's Wings

The spirit and joy of creativity as exemplified in aircraft design is the story of this film. America's Wings looks at everything that has happened since Kitty Hawk and the "somebodies" who made it happen. (28.5 minutes, 16 mm color)

The Age of Space Transportation

Every breakthrough in transportation, from the wheel to the jet engine, has brought with it enormous social change. "The Age of Space Transportation" takes a particular look at mankind's next giant step in moving around -- the Space Shuttle, the vehicle itself and its implications. (20 minutes, 16 mm)

For information on obtaining these films, contact:
American Institute of Aeronautics and Astronautics
1290 Avenue of the Americas
New York, N.Y. 10019

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Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N78-16986* + National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 90
Dec. 1977 108 p
(NASA-SP-7037(90)) Avail: NTIS HC E02 CSCL 01A

This bibliography lists 351 reports, articles, and other documents introduced into the NASA scientific and technical information system in November 1977. Author

N78-16987# Army Field Artillery School, Fort Sill, Okla.
THE MILITARY AIRSHIP: A BIBLIOGRAPHY
Lester L. Miller, Jr. 15 Dec. 1977 14 p
(AD-A047812; SB-47) Avail: NTIS HC A02/MF A01 CSCL 01/3

Morris Swett library holdings on the subject of the military balloon are covered in this survey. Author (GRA)

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N78-16988 Virginia Polytechnic Inst. and State Univ., Blacksburg.
THE EFFECT OF WHITCOMB WINGLETS AND OTHER WINGTIP MODIFICATIONS ON WAKE VORTICES Ph.D. Thesis
Henry Frederick Faery 1977 175 p
Avail: Univ. Microfilms Order No. 77-26887

Wind tunnel experiments were conducted on six wingtip configurations to determine their wake vortex characteristics. The trailing wingtip vortex was probed by a 1/8 inch diameter five hole yawhead pressure probe. The vortex tangential and axial velocity profiles are compared at five and twenty chordlengths downstream. The Whitcomb winglet and the upper winglet configuration both produce two distinct vortices of the same rotation. The maximum tangential velocity in each vortex is about 64 percent less than that produced by a conventional wingtip configuration. The lift and drag characteristics of the wingtip configurations are compared. The aerodynamic force effects of the wing on the winglet and the winglet on the wing. The downwash distribution on the wing both with and without winglets, and the effect of different winglet dihedral angles on the wing downwash pattern are discussed. Dissert. Abstr.

N78-16989 Iowa State Univ. of Science and Technology, Ames.
THE FLOW OF A LARGE SCALE GENERAL VORTEX NEAR A SOLID BOUNDARY NORMAL TO THE AXIS OF THE VORTEX Ph.D. Thesis
Hailezghi Tesfamariam 1977 175 p
Avail: Univ. Microfilms Order No. 77-26015

A simple but complete method for solving the equations that govern vortex flow along a line was developed together with a new turbulence model for turbulent flows and a new family of finite difference methods for parabolic equations. The method of analyzing a vortex flow was used to examine the flow of a vortex near solid surface. Solutions have been obtained for the case where the tangential velocity at the axial outer boundary and the radial inflow at the radial outer boundary are maintained and the flow in the axial direction is unconstrained. For this case, it was found that the structure of the vortex flow changes in time continuously and that the manner of this change depends on the nature of the radial inflow at the radial outer boundary. Dissert. Abstr

N78-16990 Maryland Univ., College Park.
EXPERIMENTAL STUDIES OF A TWO AND A THREE-DIMENSIONAL LOW SPEED TURBULENT BOUNDARY LAYER Ph.D. Thesis
Allen Edward Winkelmann 1976 375 p
Avail: Univ. Microfilms Order No. 77-26552

Experimental studies of a two and a three dimensional low speed turbulent boundary layer were conducted on the side wall of boundary layer wind tunnel. Preliminary studies in the two dimensional boundary layer indicated that the flow was nonuniform. The nonuniform boundary layer was characterized by transverse variations in the wall shear stress and was primarily caused by nonuniformities in the inlet damping screens. An extensive study of the nonuniform boundary layer was conducted using a special transverse device, developed to allow one to survey the boundary layer in a direction transverse to the mean flow and at set distances off the wall. The transverse device was also used to survey the three dimensional flow field. Dissert. Abstr.

N78-16991 Virginia Univ., Charlottesville.
AN EXPERIMENTAL INVESTIGATION OF A THREE DIMENSIONAL WALL JET Ph.D. Thesis
George Dominic Catalano 1977 213 p
Avail: Univ. Microfilms Order No. 77-28643

One and two point statistical properties were measured in the flow fields of a coflowing turbulent jet. Two different confining surfaces were placed adjacent to the lip of the circular nozzle, and the resultant effects on the flow field were determined. The one point quantities measured include mean velocities, turbulent intensities, velocity and concentration autocorrelations and power spectral densities, and intermittencies. From the autocorrelation curves, the Taylor microscale and the integral length scale were calculated. Two point quantities measured include velocity and concentration space-time correlations and pressure velocity correlations. From the velocity space-time correlations, isocorrelation contours were constructed along with the lines of maximum maximorum. These lines allowed a picture of the flow pattern to be determined. Dissert. Abstr.

N78-16992 Washington Univ., Seattle.
UNSTEADY HOVERING WAKE PARAMETERS IDENTIFIED FROM DYNAMIC MODEL TESTS Ph.D. Thesis
Samuel Tribble Crews 1977 123 p
Avail: Univ. Microfilms Order No. 77-28339

The development of a four bladed model rotor that can be excited with a simple eccentric mechanism in progressing and regressing modes with either harmonic or transient inputs was reported. Parameter identification methods were applied to the problem of extracting parameters for linear perturbation models, including rotor dynamic inflow effects, from the measured blade flapping responses to transient pitch-stirring excitations. These perturbation models were then used to predict blade flapping response to other pitch-stirring transient inputs, and rotor wake and blade flapping responses to harmonic inputs. The viability and utility of using parameter identification methods for extracting the perturbation models from transients are demonstrated through these combined analytical and experimental studies.
Dissert. Abstr.

N78-16993 Georgia Inst. of Tech., Atlanta.
AN EXPERIMENTAL INVESTIGATION OF THE VORTICES AND THE WAKE ASSOCIATED WITH A JET IN CROSS-FLOW Ph.D. Thesis
Dharmanshu L. Antani 1977 228 p
Avail: Univ. Microfilms Order No. 77-29210

The interaction between a subsonic crossflow and a turbulent, subsonic jet which exhausts normally from a flat plate were experimentally investigated. The primary objective of the investigation was to study in detail the behavior of the contrarotating vortices and the wake associated with the jet in crossflow. The behavior of the jet was determined from temperature measurements which provide the extent and the shape of the jet starting from the jet exit. A vortex meter was used to make direct measurement of the vorticity distribution in the vortices. Results were obtained providing parameters which specify the vortex location and variations in the strength and diffusion of the contrarotating vortices. The total pressure losses in the wake were measured. The interactions between the vortices, the jet, and the wake were studied from the velocity.
Dissert. Abstr.

N78-16994 Georgia Inst. of Tech., Atlanta.
DRAG ON AN OSCILLATING AIRFOIL IN A FLUCTUATING FREE STREAM Ph.D. Thesis
Sesi Bhushan Rao Kottapalli 1977 161 p
Avail: Univ. Microfilms Order No. 77-28579

The unsteady skin friction drag of an oscillating airfoil exposed to a fluctuating free stream speed was investigated. The introduction of fluctuations in the free stream alters the skin friction drag considerably by causing significant fluctuations in the drag. There is a considerable difference between the drag behaviors of an airfoil at constant incidence and one undergoing oscillations about a mean angle of attack, both subjected to identical fluctuating free streams. For an airfoil undergoing oscillations about a mean angle of attack in a fluctuating free stream, the phase (with respect to the free stream) and amplitude of the drag fluctuations are strongly dependent on the phase difference between the free stream fluctuations and airfoil oscillations. Depending on the values of the phase difference between free stream fluctuations and airfoil oscillations, reduced frequency, and amplitude of free stream fluctuations, the drag can either lead or lag the free stream. Dissert. Abstr.

N78-16995 Kansas Univ., Lawrence.
AN ANALYTICAL MODEL FOR THE STUDY OF HIGHLY SEPARATED FLOW ON LOW SPEED AIRFOILS Ph.D. Thesis
Sharad Narayanrao Naik 1977 100 p
Avail: Univ. Microfilms Order No. 77-28897

A computer program was developed to solve the low speed flow around airfoils with highly separated flow. The flow model includes all of the major physical features in the separated region. Flow visualization tests were made to substantiate to the validity of the model. The computation involves the matching of the potential flow, boundary layer and flows in the separated regions. Head's entrainment theory was used for boundary layer calculations and Korst's jet mixing analysis was used in the separated regions. A free stagnation point aft of the airfoil and a standing vortex in the separated region were modelled and computed. The separation location and pressure were found iteratively without a priori specification. A GA(W)-1, 17% thick airfoil, at three angles of attack and two Reynolds numbers, was used for the analysis. Dissert. Abstr.

N78-16996 Georgia Inst. of Tech., Atlanta.
A NUMERICAL STUDY OF INCOMPRESSIBLE VISCOUS FLOW AROUND AIRFOILS Ph.D. Thesis
Sarangan Sampath 1977 215 p
Avail: Univ. Microfilms Order No. 77-29219

An integro-differential formulation for the numerical solution of the two-dimensional incompressible Navier-Stokes equations is developed and applied to the study of dependent incompressible viscous flow past a 9% thick symmetrical airfoil. This formulation utilizes vorticity and stream function as dependent variables in the governing equations and has the capability of confining the computations to the region of non-negligible vorticity thus reducing computer time requirements for the study of external viscous flow problems and enables the exact boundary condition on velocity to be satisfied truly at infinity. Based on the integral representation for stream function, a method for the determination of vorticity on the solid surface is also presented. With this method the physical process of vorticity generation on the solid surface is correctly simulated and the principle of conservation of total vorticity is satisfied. Dissert. Abstr.

N78-16997 Purdue Univ., Lafayette, Ind.
A STUDY OF TURBULENT MIXING OF BOUNDED STREAMS Ph.D. Thesis
Edgar Allen OHair, Jr. 1977 83 p
Avail: Univ. Microfilms Order No. 77-30116

The mixing of a subsonic stream and a supersonic stream in a duct in which the static pressure of the subsonic stream at the beginning of mixing was greater than that of the supersonic stream was studied. The effect of the difference in the initial pressure is much greater than the displacement effect due to mixing. An analytical model using integral equations and an assumed velocity profile in the mixing zone and inviscid flow outside of the mixing zone was developed and compared with the experimental results. The comparison between the theory and experiments shows that the dividing streamline, established by an inviscid nonmixing calculation, establishes the downstream pressure distribution in the two streams and that the mixing solution can be superimposed on this streamline. Dissert. Abstr.

N78-16998*# Boeing Vertol Co., Philadelphia, Pa.
TWO-DIMENSIONAL WIND TUNNEL TEST OF AN OSCILLATING ROTOR AIRFOIL, VOLUME 2 Final Report
L. U. Dadone 1977 310 p
(Contract NAS1-13795)
(NASA-CR-2915; D-210-11188-2) Avail: NTIS HC A14/MF A01 CSCL 01A
For abstract, see N78-16003.

N78-16999*# Boeing Commercial Airplane Co., Seattle, Wash.
THE PRACTICAL APPLICATION OF A FINITE DIFFERENCE METHOD FOR ANALYZING TRANSONIC FLOW OVER OSCILLATING AIRFOILS AND WINGS Final Report
Warren H. Weatherill, James D. Sebastian, and E. Edwards Ehlers
Feb. 1978 88 p refs
(Contract NAS1-14204)
(NASA-CR-2933; D6-44419) Avail: NTIS HC A05/MF A01 CSCL 01A

Separating the velocity potential into steady and unsteady parts and linearizing the resulting unsteady equations for small disturbances was performed. The steady velocity potential was obtained first from the well known nonlinear equation for steady transonic flow. The unsteady velocity potential was then obtained from a linear differential equation in complex form with spatially varying coefficients. Since sinusoidal motion is assumed, the unsteady equation is independent of time. The results of an investigation into the relaxation-solution-instability problem was discussed. Concepts examined include variations in outer boundary conditions, a coordinate transformation so that the boundary condition at infinity may be applied to the outer boundaries of the finite difference region, and overlapping subregions. The

general conclusion was that only a full direct solution in which all unknowns are obtained at the same time will avoid the solution instabilities of relaxation. An analysis of the one-dimensional form of the unsteady transonic equation was studied to evaluate errors between exact and finite difference solutions. Pressure distributions were presented for a low-aspect-ratio clipped delta wing at Mach number of 0.9 and for a moderate-aspect-ratio rectangular wing at a Mach number of 0.875. Author

N78-17000*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

DYNAMIC STALL EXPERIMENTS ON THE NACA 0012 AIRFOIL

Kenneth W. McAlister, Lawrence W. Carr, and William J. McCroskey Jan. 1978 166 p refs

(NASA-TP-1100; A-7096) Avail: NTIS HC A08/MF A01 CSCL 01A

The flow over a NACA 0012 airfoil undergoing large oscillations in pitch was experimentally studied at a Reynolds number of 2.5 million and over a range of frequencies and amplitudes. Hot-wire probes and surface-pressure transducers were used to clarify the role of the laminar separation bubble, to delineate the growth and shedding of the stall vortex, and to quantify the resultant aerodynamic loads. In addition to the pressure distributions and normal force and pitching moment data that have often been obtained in previous investigations, estimates of the unsteady drag force during dynamic stall have been derived from the surface pressure measurements. Special characteristics of the pressure response, which are symptomatic of the occurrence and relative severity of moment stall, have also been examined. Author

N78-17001*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SYNTHESIS OF BLADE FLUTTER VIBRATORY PATTERNS USING STATIONARY TRANSDUCERS

A. Kurkov and J. Dicus Mar. 1977 26 p refs Proposed for presentation at Gas Turbine Conf., London, Engl., 9-13 Apr. 1978; sponsored by Am. Soc. of Mechan. Engineers

(NASA-TM-73821; E-9410) Avail: NTIS HC A03/MF A01 CSCL 01A

Flutter frequency was determined and rotor vibratory amplitude and phase distributions during flutter were reconstructed from stationary aerodynamic type measurements. A previously reported optical method for measuring blade-tip displacement during flutter was extended by means of digital analysis. Displacement amplitudes and phase angles were determined based on this method. For selected blades, spectral results were also obtained from strain gage measurements. The results from these three types of measurement were compared and critically evaluated. Author

N78-17002*# Kansas Univ. Center for Research, Inc., Lawrence. Flight Research Lab.

MINIMUM INDUCED DRAG CONFIGURATIONS WITH JET INTERACTION

Jenn Louh Pao and C. Edward Lan Feb. 1978 166 p refs (Grant NsG-1139)

(NASA-CR-155929; CRINC-FRL-281-2) Avail: NTIS HC A08/MF A01 CSCL 01A

A theoretical method is presented for determining the optimum camber shape and twist distribution for the minimum induced drag in the wing-alone case without prescribing the span loading shape. The same method was applied to find the corresponding minimum induced drag configuration with the upper-surface-blowing jet. Lan's quasi-vortex-lattice method and his wing-jet interaction theory were used. Comparison of the predicted results with another theoretical method shows good agreement for configurations without the flowing jet. More applicable experimental data with blowing jets are needed to establish the accuracy of the theory. Author

N78-17003# Lockheed Missiles and Space Co., Palo Alto, Calif.

OUTLINE OF AEROELASTIC PHENOMENA

A. S. Volmir [1978] 10 p Transl. into ENGLISH from the book "Obolochki v Potoke Zhidkosti i Gaza. Zadachi Aerouprugosti" Moscow, Nauka Press, 1976 p 70-81

Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Aeroelastic processes were examined in regard to their effect of deformation on aircraft wings, empennage, fuselage and control organs. A classification is provided of aeroelastic phenomena, and the concepts of divergence, classical flutter, panel flutter, stalling flutter, aeolian vibrations, galloping, buffeting, shaking, and washing are differentiated. Diagrams denoting aeroelasticity, aerothermoelectricity and aeroautoelasticity illustrate factors of aeroelastic strain. B.L.P.

N78-17004# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Stroemungsmechanik.

CONTRIBUTIONS TO STEADY AND UNSTEADY AERODYNAMICS

F. W. Riegels, ed. and O. Lawaczeck, ed. 10 Aug. 1977 282 p refs Partly in ENGLISH and partly in GERMAN; ENGLISH summary

(DLR-FB-77-34) Avail: NTIS HC A13/MF A01; DFVLR Cologne DM 107,30

Topics discussed are: missile aerodynamics, flow separation on wings and cascades and its control, transonic similarity for real gases in cryogenic wind tunnel models, unsteady forces and pressure distributions, acoustic problems in gas turbine power plants, performance of sailing boats, a hybrid wind tunnel concept, water jets emerging in vacuum (Spacelab), and neutron sources for fusion reactor materials tests. For individual titles, see N78-17005 through N78-17023.

N78-17005# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.

SIGNIFICANCE OF STRUCTURAL NONLINEARITIES FROM THE STRUCTURAL DYNAMICS AND AEROELASTICITY POINT OF VIEW [DIE BEDEUTUNG STRUKTURELLER NICHTLINEARITAETEN AUS DER SICHT DER STRUKTURDYNAMIK UND AEROELASTIK]

E. Breitbach *In its* Contrib. to Steady and Unsteady Aerodyn. 10 Aug. 1977 p 7-19 refs In GERMAN (For availability see N78-17004 08-02)

Avail: NTIS HC A13/MF A01; DFVLR Cologne DM 107,30

The effects of structure-dependent nonlinearities on the dynamic behavior of aircraft structures were investigated, and their significance for flutter stability analysis and for solution of general dynamic response problems considered. Some measurement and analytical compuation problems resulting from structural nonlinearities, and methods for resolving them, are discussed. Physical relations are explained using an example of rudder mechanism nonlinearities in manually controlled aircraft. ESA

N78-17006# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.

THE STALL PROBLEM [ZU DEM PROBLEM DES STALL]

P. Bublitz *In its* Contrib. to Steady and Unsteady Aerodyn. 10 Aug. 1977 p 21-32 refs In GERMAN (For availability see N78-17004 08-02)

Avail: NTIS HC A13/MF A01 DFVLR Cologne DM 107,30

An extensive literature study concerning the analysis of the complicated phenomena occurring at aerodynamic stalling is reported. The findings of this study show that the potential theory method of analysis indicates the correct tendency, but that the separation phenomenon and the vortex formation at large angles need further exploration using different methods. ESA

N78-17007# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.

UNSTEADY AERODYNAMIC FORCES ON HARMONICALLY OSCILLATING POINTED CIRCULAR CONICAL SHELLS WITH SMALL APERTURE ANGLE [INSTATIONAERE LUFTKRAEFTE AN HARMONISCH SCHWINGENDEN SPITZEN KREISKEGELSCHALEN MIT KLEINEM OEFFNUNGSWINKEL]

H. Foersching and K.-L. Chao *In its* Contrib. to Steady and Unsteady Aerodyn. 10 Aug. 1977 p 33-48 refs In GERMAN (For availability see N78-17004 08-02)

Avail: NTIS HC A13/MF A01; DFVLR Cologne DM 107,30

The analytical relations for the calculations were derived from the slender body theory. Numerical calculations were carried out for some typical examples and results compared with those of the piston theory. ESA

N78-17008# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.

THE INTERFERENCE PROBLEM OF THE OSCILLATING FUSELAGE NEAR GROUND [DAS INTERFERENZPROBLEM DES SCHWINGENDEN RUMPFES IN BODENNAEHE]

W. Geissler *In its* Contrib. to Steady and Unsteady Aerodyn. 10 Aug. 1977 p 49-60 refs In GERMAN (For availability see N78-17004 08-02)

Avail: NTIS HC A13/MF A01; DFVLR Cologne DM 107,30

A numerical method is described for calculation of the steady and unsteady pressure distributions on an axisymmetric body near ground. The method operates according to the singularity method with a continuous surface coverage of harmonically pulsating sources and sinks. The ground effect is accounted for by the mirror principle; the distance to ground may be selected freely. A stationary angle of attack (measured against the rotation axis) and several oscillation modes can be taken into consideration. Results are partly compared with measurements. ESA

N78-17009# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Stroemungsmechanik.

EFFECT OF REYNOLDS NUMBER ON THE NORMAL FORCES OF SLENDER MISSILE BODIES [UEBER DEN EINFLUSS DER REYNOLDSZAHL AUF DIE NORMALKRAEFTE SCHLANKER FLUGKOERPERRUEMPFE]

K. Hartmann *In its* Contrib. to Steady and Unsteady Aerodyn. 10 Aug. 1977 p 61-76 refs In GERMAN (For availability see N78-17004 08-02)

Avail: NTIS HC A13/MF A01; DFVLR Cologne DM 107,30

The effect of Reynolds number on the nonlinear normal forces of slender missile bodies was investigated in the transonic and in the high speed wind tunnel of the DFVLR-AVA. Extensive force and pressure distribution measurements, as well as flow visualization experiments, were carried out. The experimental results were theoretically analyzed, leading to the development of a semi-empirical theory providing a satisfactory description of the test results. ESA

N78-17010# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Dynamik Verduennter Gase.

PROPERTIES OF GAS DYNAMIC TARGETS [EIGENSCHAFTEN GASDYNAMISCHER TARGETS]

G. Hefer *In its* Contrib. to Steady and Unsteady Aerodyn. 10 Aug. 1977 p 77-91 refs In GERMAN (For availability see N78-17004 08-02)

Avail: NTIS HC A13/MF A01; DFVLR Cologne DM 107,30

A fast 14 MeV neutron source to be used for investigation of fusion reactor materials is described. Neutrons are produced by the interaction of a tritium beam with an energy of 300 keV and a deuterium flow (the target). A distinction is made between a hypersonic and a subsonic target as a function of the deuterium flow velocity. The operation is described and the basic properties of both target versions are represented in a one-dimensional calculation. It is shown that the subsonic target has certain advantages over the hypersonic version justifying further development of the concept. ESA

N78-17011# Stuttgart Univ. (West Germany). Inst. fuer Aerodynamik und Gasdynamik.

ENERGETIC EVALUATION OF THE HYBRID TUNNEL PRINCIPLE AND POSSIBILITIES OF EFFICIENCY IMPROVEMENT [ENERGETISCHE BEWERTUNG DES HYBRIDKANAL-PRINZIPS UND MOEGLICHKEITEN DER WIRKUNGSGRADVERBESSERUNG]

T. Hottner *In* DFVLR Contrib. to Steady and Unsteady Aerodyn. 10 Aug. 1977 p 93-110 refs In GERMAN (For availability see N78-17004 08-02)

Avail: NTIS HC A13/MF A01; DFVLR Cologne DM 107,30

The hybrid tunnel is a cross between a wind tunnel and a tow tunnel. The power requirement and energy consumption are considerably lower for the hybrid tunnel than for the wind tunnel. An energetic evaluation measure can be given based on energy budgets between test intervals. Its efficiency essentially depends on the duration of the air discharge from the tow tunnel in the low pressure tube as compared to the overall propagation time of the flow through the tow tunnel. It is shown how this time ratio can be improved by shock wave refraction at the bottom of the low pressure tube. ESA

N78-17012# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Stroemungsmechanik.

EFFECT OF SEPARATION BUBBLES ON THE LIFT OF WING PROFILES [UEBER DEN EINFLUSS VON ABLOESEBLASEN AUF DEN AUFTRIEB VON TRAGFLUEGELPROFILEN]

K. Jacob *In its* Contrib. to Steady and Unsteady Aerodyn. 10 Aug. 1977 p 111-123 refs In GERMAN (For availability see N78-17004 08-02)

Avail: NTIS HC A13/MF A01; DFVLR Cologne DM 107,30

The problem of high lift behavior of wing profiles as a function of profile shape and Reynolds number is dealt with. The case of the combined occurrence of trailing edge separation and a short laminar turbulent separation bubble was examined, and a method developed for overall flow calculation. Empirical criteria and relationships were used for approximative consideration of the bubble. Maximum lift calculations carried out for two profiles are in good agreement with measurements. ESA

N78-17013# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.

MEASUREMENT OF UNSTEADY PRESSURES IN ROTATING SYSTEMS [ZUR MESSUNG INSTATIONAERER DRUECKE IN ROTIERENDEN SYSTEMEN]

K. Kienappel *In its* Contrib. to Steady and Unsteady Aerodyn. 10 Aug. 1977 p 125-136 refs In GERMAN (For availability see N78-17004 08-02)

Avail: NTIS HC A13/MF A01; DFVLR Cologne DM 107,30

The principles of the experimental determination of unsteady periodic pressure distributions in rotating systems are dealt with. An indirect method is discussed, and the effects of the centrifugal force and the transmission behavior of the pressure measurement circuit are outlined. The required correction procedures are described and experimentally implemented in a test bench. Results show that the indirect method is suited to the measurement of unsteady nonharmonic pressure distributions in rotating systems. ESA

N78-17014# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Dynamik Verduennter Gase.

WIND TUNNEL INVESTIGATIONS OF WATER JETS IN VACUUM FOR THE DEVELOPMENT OF THE SPACELAB OVERBOARD DUMPING ASSEMBLY [WINDKANALUNTERSUCHUNGEN AN WASSERSTRAHLEN IM VAKUUM FUER DIE ENTWICKLUNG DES SPACELAB OVERBOARD DUMPING ASSEMBLY]

G. Koppenwallner and G. Hefer *In its* Contrib. to Steady and Unsteady Aerodyn. 10 Aug. 1977 p 137-153 refs In GERMAN (For availability see N78-17004 08-02)

Avail: NTIS HC A13/MF A01; DFVLR Cologne DM 107,30

Tests were carried out in the AVA hypersonic vacuum wind tunnel to determine the behavior of water jets suddenly emerging into vacuum. These investigations are related to the development of a facility for waste water disposal into space onboard Spacelab. Test results and some basic phenomena determining the behavior of the jets are reported. An unknown atomization mechanism was discovered. This mechanism is based on the fast cooling of the jet surface by evaporation, and a resulting temperature differential between surface and center. If a certain differential is exceeded, sudden evaporation of the center occurs leading to bursting and atomization of the water jet. ESA

N78-17015# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

PERFORMANCE CALCULATION FOR SAILING BOATS USING COMPLEX VARIABLES [LEISTUNGSRECHNUNG FUER SEGELBOOTE MITTELS KOMPLEXER GROESSEN]

K. Kraemer *In* DFVLR Contrib. to Steady and Unsteady Aerodyn. 10 Aug. 1977 p 155-175 refs In GERMAN (For availability see N78-17004 08-02)
Avail: NTIS HC A13/MF A01; DFVLR Cologne DM 107,30

The apparent velocity polars of the boat which result in the highest velocity for each course angle in relation to the apparent wind are determined, based on an equilibrium of flow forces at the sail and at the keel. The force polars of the sail and the keel are given. Complex algebra allowing a few rotary operations is shown to be useful and enables determination of the true velocity polars by means of conformal mapping. The influence of some boat parameters is discussed. ESA

N78-17016# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Stroemungsmechanik.

EFFECT OF TRIP WIRES ON THE SHOCK-BOUNDARY LAYER INDUCED SEPARATION FOR TRANSONIC TURBINE CASCADES [UEBER DIE WIRKUNG VON STOLPERDRAEHTEN AUF DIE STOSS-GRENZSCHICHT-INDUZIERTE ABLOESUNG BEI TRANSSONISCHEN TURBINENGITTERN]

O. Lawaczeck *In its* Contrib. to Steady and Unsteady Aerodyn. 10 Aug. 1977 p 177-188 refs In GERMAN (For availability see N78-17004 08-02)
Avail: NTIS HC A13/MF A01; DFVLR Cologne DM 107,30

The effect of trip wires with respect to their position and their diameter on the laminar-turbulent boundary layer transition and, as a result, on the discharge flow parameters of a transonic turbine cascade was investigated. The role of a trip wire in shifting the shock-induced flow separation to a higher discharge Mach number than that for a laminar boundary layer, was especially examined. ESA

N78-17017# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Stroemungsmechanik.

POSSIBILITIES FOR CALCULATING THE SIMILARITY PARAMETER ksi (STAR) FOR REAL GASES [UEBER EINIGE MOEGLICHKEITEN ZUR BERECHNUNG DES AEHNLICHKEITSPARAMETERS ksi (STAR) BEI REALEN GASEN]

W. Lorenz-Meyer *In its* Contrib. to Steady and Unsteady Aerodyn. 10 Aug. 1977 p 189-201 refs In GERMAN (For availability see N78-17004 08-02)
Avail: NTIS HC A13/MF A01; DFVLR Cologne DM 107,30

In connection with the problem of transferability of test results from cryogenic wind tunnel models to actual size, several authors indicate a thermodynamic similarity parameters ksi(star). A simple method for calculating this parameter is given. The resulting numbers lead to the conclusion that nitrogen practically behaves like a real gas near saturation and in the pressure range up to 4 bar. The influence of this parameter on the pressure distribution of a supercritical profile confirms this result. ESA

N78-17018# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Stroemungsmechanik.

EFFECT OF WIND TUNNEL TURBULENCE ON THE FORMATION OF TURBULENT WALL BOUNDARY LAYERS [DER EINFLUSS DER WINDKANALTURBULENZ AUF DIE AUSBILDING VON TURBULENTEN WANDGRENZSCHICHTEN]

H. U. Meier *In its* Contrib. to Steady and Unsteady Aerodyn. 10 Aug. 1977 p 203-214 refs In GERMAN (For availability see N78-17004 08-02)
Avail: NTIS HC A13/MF A01; DFVLR Cologne DM 107,30

The effect of natural and artificially produced wind tunnel turbulence on the formation of wall boundary layers was investigated. Tests were carried out in the low turbulence wind tunnel of the DFVLR-AVA, and the degree of turbulence was increased by means of cascades. The boundary layer profile formation on the plane tunnel wall was determined by overall pressure measurements at several distances from the nozzle. The variations of the form paramter, the local friction coefficient, and the wake function were determined for artificial transition from laminar to turbulent boundary layer flow using velocity profile measurements. ESA

N78-17019# Kraftwerk Union A.G., Mulheim (West Germany).

ACOUSTIC PROBLEMS IN THE PLANNING OF GAS TURBINE POWER PLANTS [AKUSTISCHE PROBLEME BEI DER PLANUNG VON GASTURBINENKRAFTWERKEN]

J. Meyer *In* DFVLR Contrib. to Steady and Unsteady Aerodyn. 10 Aug. 1977 p 215-226 refs In GERMAN (For availability see N78-17004 08-02)
Avail: NTIS HC A13/MF A01; DFVLR Cologne DM 107,30

The planning of gas turbine power plants is considered from the point of view of acoustic noise generation and its effects on humans inside and outside the plant. Some examples show to what extent primary measures at the source can reduce noise and how noise isolation or attenuation as secondary measure can be implemented outside the power plant. Cost optimization in the provision of these measures is also considered. ESA

N78-17020# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.

UNSTEADY PRESSURE DISTRIBUTION MEASUREMENTS AT TWO TRAPEZOIDAL WINGS WITH UNIT ASPECT RATIO [INSTATIONAERE DRUCKVERTEILUNGSMESSUNGEN AN ZWEI TRAPEZFLUEGELN DER STRECKUNG EINS]

E. Schmidt *In its* Contrib. to Steady and Unsteady Aerodyn. 10 Aug. 1977 p 227-242 refs In GERMAN (For availability see N78-17004 08-02)
Avail: NTIS HC A13/MF A01; DFVLR Cologne DM 107,30

Systematic unsteady pressure distribution measurements were carried out on two sharp-edged tapered wings with unit aspect ratio and tapering lambda = 1/8 and 1/2 (symmetric-circular profile, reference wing depth 1 m). A harmonic longitudinal low amplitude motion at frequencies from 2.5 to 9.4 Hz was superimposed for angles of attack from 0 to 18 deg. The flow velocity was 60 m/sec maximum. Some characteristic plots are presented which show considerable angle of attack effects upon the unsteady pressure distribution of slender wings. The measurements agree with potential theory panel method calculations for zero angle of attack. ESA

N78-17021# Technische Hochschule, Darmstadt (West Germany). Fachgebiet Technische Stroemungslehre.

CALCULATION AND MEASUREMENT OF THE AERODYNAMIC REACTION OF ASYNCHRONOUS CASCADES [BERECHNUNG UND MESSUNG DER AERODYNAMISCHEN REAKTION VON ASYNCHRONEN GITTERN]

J. H. Spurk *In* DFVLR Contrib. to Steady and Unsteady Aerodyn. 10 Aug. 1977 p 243-256 refs In GERMAN (For availability see N78-17004 08-02)
Avail: NTIS HC A13/MF A01; DFVLR Cologne DM 107,30

Calculation of the incompressible, frictionless potential flow through an asynchronous cascade, i.e., a cascade with non-periodical geometry, is discussed. The pressure distributions on asynchronous cascades with several profile shapes were measured and compared with the calculated distributions. Boundary layer calculations show that the deviations between theory and measurement can be explained by the absence or presence of friction. ESA

N78-17022# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

AERODYNAMIC CHARACTERISTICS OF A MISSILE CONFIGURATION FEATURING A WING WITH STRAKES

W. Stahl, B. Movassaghie, and G. Brohez *In* DFVLR Contrib. to Steady and Unsteady Aerodyn. 10 Aug. 1977 p 257-267 refs (For availability see N78-17004 08-02)
Avail: NTIS HC A13/MF A01; DFVLR Cologne DM 107,30

Wind tunnel tests were carried out to investigate the effects of strakes on the aerodynamic characteristics of a thin, small aspect ratio (A=2) trapezoidal wing, with sharp leading and side edges, as is used on missile configurations. These investigations were extended to a missile-like wing-body combination, equipped with these wings, with and without strakes. Normal forces and pitching moments were measured at one subsonic and one transonic Mach number (M = 0.42 and 0.83, respectively), at angles of incidence up to 18 deg. Reynolds numbers, based on the wings' chord lengths, were in the range of 1 to 2.5 times 10 to 5th power. The application of strakes led to a considerable increase in the normal force coefficients at higher

angles of incidence, both for the wing and the missile configuration in the subsonic and transonic flow. The tests were carried out in the VKI S-1 wind tunnel with a 40 cm x 40 cm slotted wall test section. Author (ESA)

N78-17023# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.

INVESTIGATION OF UNSTEADY INTERFERENCE EFFECTS ON OSCILLATING LIFTING SURFACE AND BODIES IN INCOMPRESSIBLE FLOW [UNTERSUCHUNGEN INSTATIONAERER INTERFERENZEFFEKTE AN SCHWINGENDEN AUFTRIEBSFLAECHEN UN KOERPERN IN INKOMPRESSIBLER STROEMUNG]

H. Triebstein *In its* Contrib. to Steady and Unsteady Aerodyn. 10 Aug. 1977 p 269-280 refs In GERMAN (For availability see N78-17004 08-02)

Avail: NTIS HC A13/MF A01; DFVLR Cologne DM 107,30

Unsteady differential pressure distriibution investigations on wing-horizontal tail surfaces, wing-body, wing-external store combinations, and plane cascades are reported. The effect of separate parameters, such as reduced frequency and model geometry, on the unsteady interference effects of the separate lifting surfaces and bodies was studied in particular. Experimental results of unsteady pressure distributions were compared with theoretical values and selected results are presented. Measurements were carried out in the 3-m low velocity wind tunnel and in the test stand for plane cascade of the DFVLR-AVA. ESA

N78-17024# Massachusetts Inst. of Tech., Cambridge. Aerophysics Lab.

WIND TUNNEL TESTS OF THE UPSTREAM INFLUENCE OF A CONICAL MASS SPECTROMETER PROBE Scientific Report, 1 Apr. 1976 - 31 Aug. 1977

Charles W. Halde, Richard A. Kraemer, and Benjamin Ziph Sep. 1977 84 p refs

(Contract F19628-76-C-0185)

(AD-A047739; MIT-TR-197; AFGL-TR-77-0210; SR-1) Avail: NTIS HC A05/MF A01 CSCL 04/1

Wind tunnel tests of two configurations of a mass spectrometer high altitude probe are reported. Results show that a 35 degree half angle conical nose has an attached shock wave at M=3 from 25 to 100 km altitude. Spectrographic measurements of the density and temperature perturbations at the probe tip indicate no influence below 70 km altitude with an increasing influence between 70 and 100 km. At 100 km altitude perturbations of temperature and density are still much smaller for the conical probe than for a flat faced probe. Author

N78-17025# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.

INVESTIGATION OF VTOL UPWASH FLOWS FORMED BY TWO IMPINGING JETS

Richard C. Jenkins and William G. Hill, Jr. Nov. 1977 87 p refs

(AD-A047805; RE-548) Avail: NTIS HC A05/MF A01 CSCL 20/4

This report presents results of an experimental investigation of the complex flows that occur under a VTOL vehicle operating near the ground. The effects of geometric and operating parameters on the upwash flow produced by ground impingement of two parallel subsonic jets have been modeled. This flow has been subdivided into separate, modular elements: jet impingement, wall jet behavior, stagnation line formation, and upwash flow field properties. Models have been developed and evaluated for each of these elements. These models can be used in numerical computation methods that have been developed to predict such ground effects as suckdown and upwash lift on VTOL aircraft. Parameters included in this investigation were jet velocity, distance from the ground, separation distance between jets, relative jet strength, impingement angle, and nozzle diameter. Properties of the upwash were determined by local flow measurements above the ground and by ground plane measurements of surface pressure and oil flow patterns. GRA

N78-17026# ARO, Inc., Arnold Air Force Station, Tenn.

EFFECTS OF ACOUSTIC AND VORTICAL DISTURBANCES ON THE TURBULENT BOUNDARY LAYER AT FREE-STREAM MACH NUMBER 0.5 Final Report, 1 Jul. 1974 30 Jun. 1976

Dec. 1977 100 p refs

(AD-A047921; AEDC-TR-77-73) Avail: NTIS HC A05/MF A01 CSCL 20/4

An experimental investigation of the effects of free-stream disturbances on the development of a turbulent boundary layer is described. The data, obtained at a free-stream Mach number of 0.5, indicated: (1) compared to the baseline acoustic disturbances of 133 db, acoustic disturbances of up to 150 db did not significantly alter the turbulent boundary-layer skin friction, displacement thickness, or momentum thickness and (2) compared to the baseline vortical disturbances of 0.5 percent of the free-stream velocity, vortical disturbances of one percent of the free-stream velocity considerably altered the boundary-layer skin friction, displacement thickness, and momentum thickness, as well as their growth rates. Author (GRA)

N78-17027# Civil and Environmental Engineering Development Office, Tyndall AFB, Fla. Detachment 1 (CEEDO) HQ ADTC/ECA.

SAMPLING SUBMICROMETER PARTICLES SUSPENDED IN NEAR SONIC AND SUPERSONIC FREE JETS Final Report, 23 Jul. 1975 - 15 Dec. 1976

Joseph A. Martone, Peter S. Daley, and Richard W. Boubel (Oregon State Univ.) Oct. 1977 22 p refs

(AD-A047829; CEEDO-TR-48) Avail: NTIS MF A01 CSCL 13/2

This investigation was concerned with sampling submicrometer particles in perisonic flows. Aerosol particles having a number mean diameter of 0.8 micrometers and a geometric standard deviation of 1.28 were accelerated to Mach 0.6, 0.8, 1.26, or 1.47 through a flow nozzle. Aerosol mass concentrations were determined using a small bore probe in the jet and by a large bore probe sampling isokinetically upstream of the jet nozzle. The results of both samples were compared to compute the sampling error associated with the high speed jet sample. Studies at Mach 0.8 with four sampling probes having inlet wall to bore area ratios ranging from 3.8 to 0.28 (a knife edge) demonstrated that probe wall thickness effects are not significant when the sample is extracted isokinetically. Subisokinetic experiments using the knife edged probe showed relative errors of 124 + or - 12 percent when sampling at 20 percent of the isokinetic condition. The subisokinetic results are compared favorably with the extended empirical results of other authors. For the supersonic cases it is shown that the subsonic velocity downstream of the sampling probe bow shock can be used in estimating the sampling error. Author (GRA)

N78-17028# Nielsen Engineering and Research, Inc., Mountain View, Calif.

FURTHER STUDIES OF AERODYNAMIC LOADS AT SPIN ENTRY Annual Report, 1 May 1976 - 1 May 1977

Selden B. Spangler and Michael R. Mendenhall 30 Jun. 1977 161 p refs

(Contract N00014-74-C-0344; NR Proj. 212-225; RF41411801)

(AD-A047952; NEAR-TR-141; ONR-CR212-225-3; AR-3) Avail: NTIS HC A08/MF A01 CSCL 20/4

As part of a continuing investigation of the aerodynamic loads on a fighter-bomber aircraft at spin departure, a coordinated analytical and experimental program was undertaken on vortex shedding from noncircular nose shapes. The asymmetric loads induced by nose vortex shedding at zero and nonzero sideslip are a primary cause for adverse handling qualities at high angles of attack. A theoretical analysis for vortex shedding from noncircular nose shapes at combined angles of attack and sideslip was developed. Boundary layer separation is predicted in order to determine the rate of shedding of vorticity. Comparisons with separation data on two dimensional cylinders and with measured loads and flow field velocities in the wake for inclined ogive-cylinders give reasonable agreement. Tests were conducted in the V/STOL tunnel at NASA Langley Research Center and the Nielsen Engineering - Research water tunnel on a fighter model and typical fighter nose shapes. GRA

N78-17029# European Space Agency, Paris (France).
A NUMERICAL METHOD FOR CALCULATING THE UNSTEADY AERODYNAMIC PRESSURE DISTRIBUTION ON HARMONICALLY OSCILLATING WINGS WITH CONTROL SURFACES IN SUBSONIC FLOW. THEORY AND RESULTS FOR COMPRESSIBLE FLOW, PART 2
Wolfgang Geissler Nov. 1977 52 p refs Transl. into ENGLISH of 'Ein numerisches Verfahren zur Berechnung der instationaeren aerodyn. Druckverteilung der harmonisch schwingenden Tragflaeche mit Ruder in Unterschallstroemung. Theorie u. Ergeb. fuer kompressible Stroemung, Teil 2', DFVLR, Goettingen, West Ger. Report DLR-FB-77-15, 22 Apr. 1977 Original report in GERMAN previously announced as N78-14015 Original German report available from DFVLR, Cologne DM 25,90
(ESA-TT-430; DLR-FB-77-15) Avail. NTIS HC A04/MF A01

A numerical method to calculate the unsteady pressure and force distributions on harmonically oscillating three-dimensional wings with control surfaces in subsonic flow is presented. This panel-method is based on the velocity potential and has the advantage that local unsteady lift and moment coefficients necessary for flutter investigations can be determined in a simple and sufficient way. The numerical method for compressible flow is described in detail and numerous results and comparisons with other methods and with experimental data are presented.
Author (ESA)

N78-17030# Institut Franco-Allemand de Recherches, St. Louis (France).
DETERMINATION OF SPECTRAL POWER DENSITY OF FLOW VELOCITY FLUCTUATIONS IN A SUBSONIC FREE JET [BESTIMMUNG DER SPEKTRALEN LEISTUNGSDICHTE VON SCHWANKUNGEN DER STROEMUNGSGESCHWINDIGKEIT IN EINEM UNTERSCHALL-FREISTRAHL]
H. J. Pfeifer 18 Feb. 1977 16 p refs In GERMAN
(ISL-R-102/77) Avail: NTIS HC A02/MF A01

The spectral power density of velocity fluctuations was determined in a cold subsonic free jet with an initial diameter of 80 mm in the flow velocity range from 100 m/s to 200 m/s using a laser anemometer. A distinct maximum of the spectral power density was always found within a narrow frequency range. A law could be determined for the central frequency of this range. The absolute value of the spectral power density maximum is independent of the average flow velocity in the flow zone considered.
ESA

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

No abstracts in this category.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N78-17031* National Aeronautics and Space Administration. Pasadena Office, Calif.
RULER FOR MAKING NAVIGATIONAL COMPUTATIONS Patent
Lawrence Holmes, Jr., inventor (to NASA) (TRW Inc., Redondo Beach, Calif.) Issued 18 Jan. 1966 7 p Filed 18 Dec. 1961 Sponsored by NASA
(NASA-Case-XNP-01458; US-Patent-3,229,905; US-Patent-Appl-SN-160093; US-Patent-Class-235-70) Avail: US Patent Office CSCL 17G

An extensivle ruler used as a computer in navigation to calculate travel time between map points or to calculate ground speed is described. The ruler has a time scale that can be adjusted at length to equal map distances travelled at a designated speed in a time period such as sixty minutes. A means for fixing the length of the ruler is also provided.
B.B.

N78-17032*# Ohio Univ., Athens. Dept. of Electrical Engineering.
LORAN-C DIGITAL WORD GENERATOR FOR USE WITH A KIM-1 MICROPROCESSOR SYSTEM
James D. Nickum Dec. 1977 14 p refs
(Grant NGR-36-009-017)
(NASA-CR-155304; TM-54) Avail: NTIS HC A02/MF A01 CSCL 17G

The problem of translating the time of occurrence of received Loran-C pulses into a time, referenced to a particular period of occurrence is addressed and applied to the design of a digital word generator for a Loran-C sensor processor package. The digital information from this word generator is processed in a KIM-1 microprocessor system which is based on the MOS 6502 CPU. This final system will consist of a complete time difference sensor processor for determining position information using Loran-C charts. The system consists of the KIM-1 microprocessor module, a 4K RAM memory board, a user interface, and the Loran-C word generator.
Author

N78-17033*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
AN ALGORITHM FOR THE AUTOMATIC SYNCHRONIZATION OF OMEGA RECEIVERS Final Report
William M. Stonestreet and Thomas L. Marzetta Jan. 1977 35 p refs
(Contract NAS1-14391)
(NASA-CR-145228; R-1047) Avail: NTIS HC A03/MF A01 CSCL 17G

The Omega navigation system and the requirement for receiver synchronization are discussed. A description of the synchronization algorithm is provided. The numerical simulation and its associated assumptions were examined and results of the simulation are presented. The suggested form of the synchronization algorithm and the suggested receiver design values were surveyed. A FORTRAN of the synchronization algorithm used in the simulation was also included.
Author

N78-17034# Electromagnetic Compatibility Analysis Center, Annapolis, Md.
AUTOMATED UHF FREQUENCY ASSIGNMENT SYSTEM FOR FAA AIR TRAFFIC CONTROL COMMUNICATIONS Final Report
Thomas Hensler and John Morrow Jun. 1977 94 p Prepared in cooperation with IIT Research Inst., Annapolis
(Contract DOT-FA70WAI-175)
(AD-A047847; FAA-RD-77-96; ECAC-PR-77-012) Avail: NTIS HC A05/MF A01 CSCL 17/7

An automated UHF Frequency Assignment System (UHF-FAS) was developed as a means of providing frequency assignment plans for FAA Air Traffic Control (ATC) UHF communications facilities. The UHF-FAS consists of a series of computer programs and can be used to investigate the advantages of different frequency assignment strategies (including partial and complete assignments), detect assignments that do not meet the FAA criterion, provide statistical analyses, and plot ATC service volumes.
Author

N78-17035# Lincoln Lab., Mass. Inst. of Tech., Lexington.
PROPOSED TECHNICAL CHARACTERISTICS FOR THE DISCRETE ADDRESS BEACON SYSTEM (DABS)
J. D. Welch and P. H. Robeck 30 Sep. 1977 63 p
(Contracts DOT-FA72WAI-261; F19628-76-C-0002; FAA Proj. 034-241-012)
(AD-A048246; ATC-71; FAA-RD-77-143) Avail: NTIS HC A04/MF A01 CSCL 17/7

A detailed performance specification for the DABS transponder is provided, including specifications on transponder receiver

sensitivity and performance in interference. Specifications for a proposed digital datalink interface are included and message and control fields associated with experimental transponder data applications are defined. Guidance material on the performance of an optional transponder antenna diversity scheme is presented. Author

N78-17036# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DEVELOPMENT OF A DISCRETE ADDRESS BEACON SYSTEM Quarterly Technical Summary, 1 Jul. - 30 Sep. 1977
1 Oct. 1977 23 p
(Contracts DOT-FA72WAI-261; F19628-76-C-0002; FAA Proj. 034-241-012)
(AD-A048247; FAA-RD-77-159; QTS-23) Avail: NTIS HC A02/MF A01 CSCL 17/7

Analytical studies, laboratory and flight experiments, and software developments supporting the concept feasibility and performance definition phase of the FAA DABS Program are described. Topics considered include: antenna pattern measurements on the first of two candidate L-band monopulse antennas (modified hogtrough); design effort on the Calibration and Performance Monitor Equipment slated for prototype sensor evaluation; and the initial stage of validating the performance of Aircraft Reply and Interference Environment Simulator as interfaced with the DABS sensor at DABSEF. J.M.S.

N78-17037*# Research Triangle Inst., Research Triangle Park, N. C.
INVESTIGATION OF NEW TECHNIQUES FOR AIRCRAFT NAVIGATION USING THE OMEGA NAVIGATION
Ernest G. Baxa, Jr. Feb. 1978 238 p refs
(Contract NAS1-14005)
(NASA-CR-145303; RTI-4378-1152-F) Avail: NTIS HC A11/MF A01 CSCL 17G

An OMEGA navigation receiver with a microprocessor as the computational component was investigated. A version of the INTEL 4004 microprocessor macroassembler suitable for use on the CDC-6600 system and development of a FORTRAN IV simulator program for the microprocessor was developed. Supporting studies included development and evaluation of navigation algorithms to generate relative position information from OMEGA VLF phase measurements. Simulation studies were used to evaluate assumptions made in developing a navigation equation in OMEGA Line of Position (LOP) coordinates. Included in the navigation algorithms was a procedure for calculating a position in latitude/longitude given an OMEGA LOP fix. Implementation of a digital phase locked loop (DPLL) was evaluated on the basic of phase response characteristics over a range of input phase variations. Included also is an analytical evaluation on the basis of error probability of an algorithm for automatic time synchronization of the receiver to the OMEGA broadcast format. The use of actual OMEGA phase data and published propagation prediction corrections to determine phase velocity estimates was discussed. Author

N78-17038# Aston Univ., Birmingham (England). Dept. of Applied Psychology.
HUMAN FACTORS AND AERODROME AIR TRAFFIC CONTROL
R. B. Stammers Oct. 1975 19 p refs Revised
(AP-58) Avail: NTIS HC A02/MF A01

Human factors problems in aerodrome air traffic control are reviewed. The nature of the tasks and methods of studying them is considered. Literature in this area is reviewed and likely areas of development of new systems are mentioned. Author

N78-17039# Analytic Sciences Corp., Reading, Mass.
STANDARDIZATION POTENTIAL ACROSS NAVIGATION SYSTEMS SPANS Final Report, 15 Apr. 1976 - 15 Apr. 1977
Robert K. Gates and Robert F. Shipp 30 Sep. 1977 122 p refs
(Contract F33615-76-C-1121)
(AD-A047937; TASC-TR-840-1; AFAL-TR-77-188) Avail: NTIS HC A06/MF A01 CSCL 17/7

The objective of the SPANS effort is to assess the potential for standardization across avionic navigation systems by identifying standard hardware and software configurations that minimize life-cycle costs while satisfying Air Force operational requirements. The primary output of the effort is a computerized Standardization Evaluation Program (STEP) that quantifies the impact of standardization in those areas of avionics (such as navigation) defined by the program data base. The methodology uses a life-cycle cost model in an iterative manner over a number of aircraft and their associated mission profiles. The life cycle cost model is sensitive to the cost benefits, obtained by widespread use of standard equipment across several aircraft, through cost learning and reliability improvement functions. The SPANS data base consists of three files, including aircraft/mission data, navigation subsystem data and standard cost factors data, that provide the inputs necessary for operation of the STEP program. GRA

N78-17040# Rockwell International Corp., Anaheim, Calif. Autonetics Group.
MICRO NAVIGATOR (MICRON) PHASE 2B. VOLUME 2: APPENDICES Final Report, 5 Aug. 1975 - 25 Feb. 1977
Joseph M. Miller, A. P. Andrews, T. F. Brasher, H. L. Bump, and J. D. Courtier Aug. 1977 356 p
(Contract F33615-75-C-1301)
(AD-A048001; C75-787/201-Vol-2; AFAL-TR-77-138-Vol-2) Avail: NTIS HC A16/MF A01 CSCL 17/7

The Micro Navigator (MICRON) is a low-cost highly reliable, and moderately accurate strapdown inertial navigator. System analyses, studies, and tradeoffs were made which resulted in improved accuracy, reliability, producibility, and life cycle costs. Design specifications were prepared and maintained. Integration testing was conducted to establish system compatibility and operability. Seventeen navigation performance runs, including two demonstration runs, were made during integration testing. Position and velocity errors were well within (approximately one-half) the contract requirement. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N78-17041*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY STUDY OF PROPULSION SYSTEMS AND AIRPLANE WING PARAMETERS FOR A US NAVY SUBSONIC V/STOL AIRCRAFT
C. L. Zola, L. H. Fishbach, and J. L. Allen Feb. 1978 42 p refs
(NASA-TM-73652; E-9519) Avail: NTIS HC A03/MF A01 CSCL 01C

Two V/STOL propulsion concepts were evaluated in a common aircraft configuration. One propulsion system consists of cross coupled turboshaft engines driving variable pitch fans. The other system is a gas coupled combination of turbojet gas generators and tip turbine fixed pitch fans. Evaluations were made of endurance at low altitude, low speed loiter with equal takeoff fuel loads. Effects of propulsion system sizing, bypass ratio, and aircraft wing planform parameters were investigated and compared. Shaft driven propulsion systems appear to result in better overall performance, although at higher installed weight, than gas systems. Author

N78-17042*# National Aeronautics and Space Administration, Washington, D. C.
AEROSPATIALE IS READY TO DEVELOP A CONVERTIPLANE WITH TETHERING ROTORS
Jacques Morisset Aug. 1977 11 p Transl. into ENGLISH from Air et Cosmos (France), no. 662, 12 Mar. 1977 p 19-22 Translation was announced as A77-26913 Transl. by Transemantics Inc., Washington, D.C.
(Contract NASw-2792)
(NASA-TM-75038) Avail: NTIS HC A02/MF A01 CSCL 01C

Information on the recent study of the convertiplane is

reported. The convertiplane was designed to replace the conventional helicopter. Its speed is much faster than that of the helicopter, it uses less fuel, and can carry up to five passengers. The discovery of the convertiplane was brought about because the helicopter is handicapped by its slow speed and can carry only a few passengers. Author

N78-17043# Lockheed Missiles and Space Co., Palo Alto, Calif.
SUPERELEMENT METHOD OF DESIGNING A HELICOPTER FUSELAGE
O. M. Aksenov and Z. I. Burman [1978] 6 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Aviats. Tekh. (USSR), no. 2, 1977 p 12-17
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

A method of helicopter fuselage design, based on separated fuselage substructures known as superelements, is developed for full-scale fuselages. The theory and general algorithm utilizing the method of forces are presented. B.L.P.

N78-17044# McDonnell Aircraft Co., St. Louis, Mo.
STRESS HISTORY SIMULATION. VOLUME 2: A USERS MANUAL FOR A COMPUTER PROGRAM TO MODIFY STRESS HISTORY SIMULATIONS Final Report, May 1975 - Jul. 1976
H. T. Young, F. R. Foster, and H. D. Dill Mar. 1977 133 p refs
(Contract F33615-75-C-3112)
(AD-A042785; AFFDL-TR-76-113-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 01/3

This report presents a description of a computer program to combine and modify stress history simulations generated by a companion computer program described in Volume I. Input random stress history data sets are combined and modified to create stress spectra variations. Each variation is characterized by its mission mix; a mission mix consists of a particular order of mission types (Air-to-Air, Air-to-Ground, and Instrumentation and Navigation). An example problem is included which demonstrates the program output; a sequential list of peaks and valleys of the flight by flight spectrum, and a summary table of the coupling of the peaks and valleys. Both of the computer programs were used in a study of load sequence effects on crack growth, summarized in AFFDL-TR-76-112, 'Effects of Fighter Attack Spectrum on Crack Growth'. Author (GRA)

N78-17045# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
STATISTICAL REVIEW OF COUNTING ACCELEROMETER DATA FOR NAVY AND MARINE FLEET AIRCRAFT FROM 1 JANUARY 1962 TO 30 JUNE 1977 Semiannual Summary Report
Alan M. Kaniss 1 Nov. 1977 157 p Supersedes report dated 1 May 1977
(AD-A047857) Avail: NTIS HC A08/MF A01
CSCL 01, 4

This report is a specialized summary of normal acceleration data recorded by counting accelerometers. Data are separated by calendar time and mission category. Only data reported in the counting accelerometer program are included. Author (GRA)

N78-17046# Army Aeromedical Research Lab., Fort Rucker, Ala.
TOXICOLOGIC GAS EVALUATION OF THE UTILITY TACTICAL TRANSPORT AIRCRAFT SYSTEM (UH-60) Final Report
Richard L. Schumaker and Gary D. Pollard Jul. 1977 13 p refs
(AD-A047801; USAARL-77-18) Avail: NTIS HC A02/MF A01 CSCL 01/3

The accumulation of toxic gases in US Army combat and combat support aircraft presents a significant hazard for the aircrew in addition to the combat forces and aeromedical evacuation patients being transported. The US Army Aeromedical Research Laboratory is conducting an on-going evaluation of the cockpit and cabin environment of current and future helicopter and fixed wing aircraft. Toxic product accumulation evaluation during actual flight with weapons firing presents a difficult technicologic challenge. This study of toxic gases due to aircraft engine operation and weapons firing demonstrates adequate ventilation for the compounds carbon monoxide, nitrogen dioxide, nitric oxide, sulfur dioxide, and hydrogen cyanide. Single samples of hydrogen sulfide demonstrate instantaneous toxic levels. Biochemical and analytical techniques are being refined to further evaluate on-line, in-flight hydrogen sulfide levels in US Army aircraft under actual combat conditions. Author (GRA)

N78-17047# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A DISCRETE-EVENT DIGITAL SIMULATION MODEL OF THE F-16 FIRE CONTROL COMPUTER OPERATIONAL FLIGHT PROGRAM USING SIMSCRIPT 2.5 M.S. Thesis
L. R. Hanson Dec. 1977 108 p refs
(AD-A048164; AFIT/GE/MA/77-1) Avail: NTIS HC A06/MF A01 CSCL 09/2

In support of a request from the Air Force Avionics Laboratory, a model of the F-16 Fire Control Computer (FCC) Operational Flight Program (OFP) was developed. The initial specification required that this model allow for possible changes to the rate of accomplishment of various OFP mode-dependent tasks. The reconfiguration of the input and output tasks and the processing reserve were of particular interest. In order to determine the most useful approach, the various computer system modeling relationships are first reviewed. Based on the author's background, the real world system and the modeling goals, a discrete event queue level simulation using SIMSCRIPT 2.5 is selected as the desired approach. The basic features of the F-16 FCC and the OFP are discussed and a description of the task movement in the system is provided. This description is used to detail the various rate groups and their member tasks. The model is verified by comparison against data derived from an actual system run and a statistical analysis provided by the OFP manufacturer. The verification process showed that all the original design objectives were met, although several areas of possible improvement to the model are indicated and discussed. Author (GRA)

N78-17048# Advisory Group for Aerospace Research and Development, Paris (France).
APPLICATIONS OF STRUCTURAL OPTIMIZATION FOR STRENGTH AND AEROELASTIC DESIGN REQUIREMENTS
Warner Lansing (Grumman Aerospace Corp., Bethpage, N. Y.), Edwin Lerner, and Ronald F. Taylor (AFFDL) Jan. 1978 25 p refs Presented at the 45th Struct. and Mater. Panel Meeting, Voss, Norway, Sep. 1977
(AGARD-R-664; ISBN-92-835-1269-3) Avail: NTIS HC A02/MF A01

The need to design airframe components of minimum weight, while taking into account both strength and aeroelastic requirements, has been recognized for some time. An historical review is presented of optimization technology development and a state of the art survey of methods in use by the U.S. industry that indicate considerable progress was made in automating this aspect of the airframe design process. It is concluded that algorithms for addressing strength and flutter are now sufficiently developed for practical use at all levels of design, and for addressing other aeroelastic design objectives in the preliminary design stage. It is recommended that airframe designers utilize these methods more extensively in future aircraft development programs. Additional effort is needed to extend some of the finite element resizing techniques so that static aeroelastic design objectives can be treated as effectively as flutter-speed requirements, and additional computer software development is always desirable to upgrade analysis and data management capabilities. Author

N78-17049# Advisory Group for Aerospace Research and Development, Paris (France).
TECHNICAL EVALUATION REPORT ON THE FLIGHT MECHANICS PANEL SYMPOSIUM ON ROTORCRAFT DESIGN
H. R. Velkoff (Ohio State Univ., Columbus) Jan. 1978 14 p refs Symp. held at NASA Ames Research Center, Moffett Field, Calif., 16-19 May 1977
(AGARD-AR-114; ISBN-92-835-1273-1) Avail: NTIS HC A02/MF A01

The status of rotorcraft design and development, the possible divergence of the development pattern of military and civil

helicopters, and the possibilites for greater coordination in the development of future rotary wing aircraft are considered. Specific topics discussed include: (1) military requirements and new military rotorcraft; (2) civil operations and new civil helicopters; (3) rotary wing aircraft research vehicles; (4) wind tunnel and flight research; (5) common ground for military and civil cooperation in the development of rotary wing aircraft; and (6) coordination of military and civil requirements and specifications. It is recommended to seek out ways to maximize common mission and design features to reduce overlapping costs and increase production. J.M.S.

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N78-17050*# Santa Clara Univ., Calif. Dept. of Electrical Engineering and Computer Science.
AIRCRAFT ATTITUDE MEASUREMENT USING A VECTOR MAGNETOMETER
R. Peitila and W. R. Dunn, Jr. 1 Dec. 1977 170 p refs
(Grant NGR-05-017-031)
(NASA-CR-155565) Avail: NTIS HC A08/MF A01 CSCL 01D

The feasibility of a vector magnetometer system was investigated by developing a technique to determine attitude given magnetic field components. Sample calculations are then made using the earth's magnetic field data acquired during actual flight conditions. Results of these calculations are compared graphically with measured attitude data acquired simultaneously with the magnetic data. The role and possible implementation of various reference angles are discussed along with other pertinent considerations. Finally, it is concluded that the earth's magnetic field as measured by modern vector magnetometers can play a significant role in attitude control systems. Author

N78-17051*# Santa Clara Univ., Calif. Dept of Electrical Engineering and Computer Science.
EVALUATION OF STOL NAVIGATION AVIONICS Final Technical Report
W. R. Dunn, Jr. 1 Dec. 1977 276 p refs
(Grant NGR-05-017-031)
(NASA-CR-155566) Avail: NTIS HC A13/MF A01 CSCL 01D

Research projects, including work on a vector magnetometer for aircraft attitude measurement, are summarized. The earth's electric field phenomena was investigated in its application to aircraft control and navigation. Research on electronic aircraft cabin noise suppression is reviewed and strapdown inertial reference unit technical support is outlined. B.L.P.

N78-17052*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INSTRUMENTATION FOR PROPULSION SYSTEMS DEVELOPMENT
Isidore Warshawsky 1978 24 p refs Presented at the Soc. of Automotive Engr. Congr. (Meeting 1M21), Detroit, 27 Feb. - 3 Mar. 1978
(NASA-TM-73840) Avail: NTIS HC A02/MF A01 CSCL 01D

Apparatus and techniques developed or used by NASA-Lewis to make steady state or dynamic measurements of gas temperature, pressure, and velocity and of the temperature, tip clearance, and vibration of the blades of high-speed fans or turbines are described. The advantages and limitations of each instrument and technique are discussed and the possibility of modifying them for use in developing various propulsion systems is suggested. Author

N78-17053*# National Aeronautics and Space Administration, Washington, D. C.
EXPERIMENTAL TESTING OF FLIGHT CONTROL HEAD UP DISPLAYS
M. Berjal Jan. 1978 15 p Transl. into ENGLISH of "Experimentation de Dispositifs de Pilotage Tete Haute", Rept. Vol. 2, Editions Chiron Electron. and Civil Aviation: Intern. Conf. (Paris), 1972 p 1033-1046 Translation was announced as A73-32508 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-2790)
(NASA-TM-75205) Avail: NTIS HC A02/MF A01 CSCL 01D

Experiments and tests with 4 generations of head up displays was reported. The CV 191, based on fighter aircraft gunsights was replaced by the CV 193, with several improvements. The CV 193 V incorporates the velocity vector reference mark, eliminates much other data, clusters the rest in a small area of the visual field and is seen together with the outside landscape. The CV 91 presents only velocity vector and total angle of descent data, used when runway and horizon are visible; TC 121 displays an outline of the runway and can be used in visual and instrument approaches. Author

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N78-17054 Tennessee Univ., Knoxville.
AN ANALYSIS OF THE INFLUENCE OF SOME EXTERNAL DISTURBANCES ON THE AERODYNAMIC STABILITY OF TURBINE ENGINE AXIAL FLOW FANS AND COMPRESSORS Ph.D. Thesis
William F. Kimzey 1977 287 p
Avail: Univ. Microfilms Order No. 77-27675

The development of a one-dimensional, time-dependent mathematical compressor model for analysis of planar disturbances and an extension of the model to a three-dimensional form for analysis of distortion was accomplished. Compressor stage force and shaft work were determined from empirical stage characteristics with corrections made for unsteady cascade airfoil aerodynamics. Example problems solved using the one-dimensional analysis include: determination of the steady-state state stability limit with undisturbed flow, instability caused by oscillating planar inflow, and dynamic response of a compressor to oscillating entry pressure. Example problems solved using the distortion model include: stability limit line reduction caused by a combined radial and circumferential pressure distortion, and pure pressure and temperature circumferential distortion effects. Dissert. Abstr.

N78-17055* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VARIABLE THRUST NOZZLE FOR QUIET TURBOFAN ENGINE AND METHOD OF OPERATING SAME Patent
Arthur P. Adamson, inventor (to NASA) (GE, Cincinnati, Ohio) Issued 17 Jan. 1978 7 p Filed 29 May 1975 Sponsored by NASA
(NASA-Case-LEW-12317-1; US-Patent-4,068,469; US-Patent-Appl-SN-581750; US-Patent-Class-60-204; US-Patent-Class-60-226R; US-Patent-Class-60-271) Avail: US Patent Office CSCL 21E

An improved method of operating a gas turbine engine is presented wherein engine-generated noise is maintained at a reduced level during reduced thrust operation. Fan speed was maintained at a constant level while fan nozzle area was increased. This maintained high inlet Mach numbers for reduced forward noise propagation and also permited reduced nozzle exhaust velocity for reduced shear noise. In another embodiment, airflow was increased by means of a fan blade pitch change or speed increase while the fan nozzle area was increased, yielding both a net reduction in engine thrust and noise.
Official Gazette of the U.S. Patent Office

N78-17056* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GAS TURBINE ENGINE WITH CONVERTIBLE ACCESSORIES Patent

Donald F. Sargisson (GE, Cincinnati, Ohio) and Arthur P. Adamson, inventors (to NASA) Issued 17 Jan. 1978 6 p Filed 8 Nov. 1974 Sponsored by NASA
(NASA-Case-LEW-12390-1; US-Patent-4,068,470; US-Patent-Appl-SN-522109; US-Patent-Class-60-226R; US-Patent-Class-74-385; US-Patent-Class-74-417) Avail: US Patent Office CSCL 21E

Drive means for connecting a gas turbine engine to its accessories are so constructed as to allow the accessories to be selectively positioned to any one of several predetermined circumferential positions about the perimeter of the engine. This feature permits convenient mounting of the same engine upon vehicles demanding radically different engine mounting arrangements. Official Gazette of the U.S. Patent Office

N78-17057*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INTERNAL PERFORMANCE PREDICTIONS FOR LANGLEY SCRAMJET ENGINE MODULE
S. Z. Pinckney Jan. 1978 81 p refs
(NASA-TM-X-74038) Avail: NTIS HC A05/MF A01 CSCL 21E

A one dimensional theoretical method for the prediction of the internal performance of a scramjet engine is presented. The effects of changes in vehicle forebody flow parameters and characteristics on predicted thrust for the scramjet engine were evaluated using this method, and results are presented. A theoretical evaluation of the effects of changes in the scramjet engine's internal parameters is also presented. Theoretical internal performance predictions, in terms of thrust coefficient and specific impulse, are provided for the scramjet engine for free stream Mach numbers of 5, 6, and 7, free stream dynamic pressure of 23,940 N/sq m, forebody surface angles of 4.6 deg to 14.6 deg, and fuel equivalence ratio of 1.0. Author

N78-17058*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Government Products Div.
ANALYTICAL STUDY OF THERMAL BARRIER COATED FIRST-STAGE BLADES IN AN F100 ENGINE Progress Report, 1 Sep. 1977 - 31 Jan. 1978
D. E. Andress Feb. 1978 27 p
(Contract NAS3-21032)
(NASA-CR-135359; FR-9609) Avail: NTIS HC A03/MF A01 CSCL 21E

Heat transfer and stress analyses were performed on two sections of a thermal barrier coated (TBC) F100 1st-stage turbine blade. Results of the analyses indicate that the TBC on the leading edges of both sections experience the highest elastic strain ranges and these occur during transient engine operation. Further study is recommended to determine the effects of plastic deformation (creep) and creep-fatigue interaction on coating life. Author

N78-17059*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CERAMICS IN GAS TURBINE: POWDER AND PROCESS CHARACTERIZATION
Sunil Dutta 1977 16 p refs Presented at the Conf. on Composites and Advanced Maters., Cocoa Beach, Fla., 17-19 Jan. 1977; Sponsored by Am. Ceramic Soc.
(NASA-TM-73875; E-9475) Avail: NTIS HC A02/MF A01 CSCL 21E

Some of the intrinsic properties of various forms of Si3N4 and SiC are listed and limitations of such materials' availability are pointed out. The essential features/parameters to characterize a batch of powder are discussed including the standard techniques for such characterization. In process characterization, parameters in sintering, reaction sintering, and hot pressing processes are discussed including the factors responsible for strength limitations in ceramic bodies. Significant improvements in material properties can be achieved by reducing or eliminating the strength limiting factors with consistent powder and process characterization along with process control. Author

N78-17060*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GENERAL AVIATION ENERGY-CONSERVATION RESEARCH PROGRAMS AT NASA-LEWIS RESEARCH CENTER
Edward A. Willis 1977 26 p refs Presented at the Conf. on Energy Conserv. in Gen. Aviation, Kalamazoo, Mich., 10 - 11 Oct. 1977; sponsored by Western Michigan Univ.
(NASA-TM-73884) Avail: NTIS HC A03/MF A01 CSCL 21E

The major thrust of NASA's nonturbine general aviation engine programs is directed toward (1) reduced specific fuel consumption, (2) improved fuel tolerance, and (3) emission reduction. Current and planned future programs in such areas as lean operation, improved fuel management, advanced cooling techniques and advanced engine concepts, are described. These are expected to lay the technology base, by the mid to latter 1980's, for engines whose total fuel costs are as much as 30% lower than today's conventional engines. Author

N78-17061*# Raman Aeronautics Research and Engineering, Inc., Palo Alto, Calif.
AN ANALYSIS OF THE ROTOR BLADE STRESSES OF THE THREE STAGE COMPRESSOR OF THE AMES RESEARCH CENTER 11- BY 11-FOOT TRANSONIC WIND TUNNEL Final Report
Jules B. Dods, Jr. Nov. 1977 147 p refs
(Contract NAS2-9112)
(NASA-CR-152083) Avail: NTIS HC A07/MF A01 CSCL 21E

The static and dynamic rotor blade stresses of the three stage compressor were measured. Data are presented in terms of total blade stress for the complete operational range of compressor speeds and tunnel total pressures. Modal frequencies and variations with tunnel conditions were measured. Phase angles and coherences between various gage combinations are also presented. Recommendations for improvements are given for future rotor blade experimental investigations. Author

N78-17062*# Boeing Co., Seattle, Wash.
LOW SPEED TEST OF A HIGH-BYPASS-RATIO PROPULSION SYSTEM WITH AN ASYMMETRIC INLET DESIGNED FOR A TILT-NACELLE V/STOL AIRPLANE
J. Syberg Jan. 1978 115 p refs
(Contract NAS2-9640)
(NASA-CR-152072; D-180-22888-1) Avail: NTIS HC A06/MF A01 CSCL 21E

A large scale model of a lift/cruise fan inlet designed for a tilt nacelle V/STOL airplane was tested with a high bypass ratio turbofan. Testing was conducted at low freestream velocities with inlet angles of attack ranging from 0 deg to 120 deg. The operating limits for the nacelle were found to be related to inlet boundary layer separation. Small separations originating in the inlet diffuser cause little or no performance degradation. However, at sufficiently severe freestream conditions the separation changes abruptly to a lip separation. This change is associated with a significant reduction in nacelle net thrust as well as a sharp increase in fan blade vibratory stresses. Consequently, the onset of lip separation is regarded as the nacelle operating limit. The test verified that the asymmetric inlet design will provide high performance and stable operation at the design forward speed and angle of attack conditions. At some of these, however, operation near the lower end of the design inlet airflow range is not feasible due to the occurrence of lip separation. Author

N78-17063*# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.
OPTIMIZATION STUDY FOR HIGH SPEED RADIAL TURBINE WITH SPECIAL REFERENCE TO DESIGN VARIABLES
I. Khalil and W. Tabakoff Oct. 1977 67 p refs Prepared in cooperation with Army Air Mobility Research and Development Lab., Moffett Field, Calif.
(Contract NAS2-7850)
(NASA-CR-152094) Avail: NTIS HC A04/MF A01 CSCL 21E

Numerical results of a theoretical investigation are presented to provide information about the effect of variation of the different design and operating parameters on radial inflow turbine performance. The effects of variations in the mass flow rate, rotor tip Mach number, inlet flow angles, number of rotor blades and hub to shroud radius ratio, on the internal fluid dynamics

of turbine rotors, were investigated. A procedure to estimate the flow deviation angles at the turbine exit is also presented and used to examine the influence of the operating conditions and the rotor geometrical configuration on these deviations. The significance of the results obtained is discussed with respect to improved turbine performance. Author

N78-17064*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
METHOD OF FAN SOUND MODE STRUCTURE DETERMINATION Final Report
G. F. Pickett, T. G. Sofrin, and R. W. Wells Aug. 1977 160 p refs
(Contract NAS3-20047)
(NASA-CR-135293; PWA-5554-3) Avail: NTIS HC A08/MF A01 CSCL 21E

A method for the determination of fan sound mode structure in the Inlet of turbofan engines using in-duct acoustic pressure measurements is presented. The method is based on the simultaneous solution of a set of equations whose unknowns are modal amplitude and phase. A computer program for the solution of the equation set was developed. An additional computer program was developed which calculates microphone locations the use of which results in an equation set that does not give rise to numerical instabilities. In addition to the development of a method for determination of coherent modal structure, experimental and analytical approaches are developed for the determination of the amplitude frequency spectrum of randomly generated sound models for use in narrow annulus ducts. Two approaches are defined: one based on the use of cross-spectral techniques and the other based on the use of an array of microphones. Author

N78-17065*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
METHOD OF FAN SOUND MODE STRUCTURE DETERMINATION COMPUTER PROGRAM USER'S MANUAL: MICROPHONE LOCATION PROGRAM
G. F. Pickett, R. A. Wells, and R. A. Love Aug. 1977 72 p refs
(Contract NAS3-20047)
(NASA-CR-135294; PWA-5554-4) Avail: NTIS HC A04/MF A01 CSCL 21E

A computer user's manual describing the operation and the essential features of the microphone location program is presented. The Microphone Location Program determines microphone locations that ensure accurate and stable results from the equation system used to calculate modal structures. As part of the computational procedure for the Microphone Location Program, a first-order measure of the stability of the equation system was indicated by a matrix 'conditioning' number. Author

N78-17066*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
METHOD OF FAN SOUND MODE STRUCTURE DETERMINATION COMPUTER PROGRAM USER'S MANUAL: MODAL CALCULATION PROGRAM
G. F. Pickett, R. A. Wells, and R. A. Love Aug. 1977 74 p refs
(Contract NAS3-20047)
(NASA-CR-135295; PWA-5554-5) Avail: NTIS HC A04/MF A01 CSCL 21E

A computer user's manual describing the operation and the essential features of the Modal Calculation Program is presented. The modal Calculation Program calculates the amplitude and phase of modal structures by means of acoustic pressure measurements obtained from microphones placed at selected locations within the fan inlet duct. In addition, the Modal Calculation Program also calculates the first-order errors in the modal coefficients that are due to tolerances in microphone location coordinates and inaccuracies in the acoustic pressure measurements. Author

N78-17067# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
DEVELOPMENT OF COST ESTIMATING RELATIONSHIPS FOR AIRCRAFT JET CORE-ENGINE OVERHAUL COSTS M.S. Thesis
Robert A. Breglio, Jr. Sep. 1977 160 p refs
(AD-A047667; AFIT-LSSR-31-77B) Avail: NTIS HC A08/MF A01 CSCL 21/5

Cost estimation is a wide open area within the Department of Defense and accurate cost estimating models are a valuable tool in the life cycle costing of a weapon system. This research effort utilized multiple linear regression analysis to develop parametric cost models or cost estimating relationships (CERs) for jet engine depot overhaul costs. Both engine operating parameters, e.g., turbine inlet temperature, RPM, etc., and engine physical characteristics, e.g., length, weight etc., were considered as probable cost drivers. Extensive analysis was performed to determine the reliability of the data base. The major finding of this study was that models can be developed with acceptable explanatory power, with respect to variation in the data base, using data of questionable reliability. Thus, a model developed should not be accepted on the basis of explanatory power alone but should be tested further to determine its utility as a cost estimator. Author (GRA)

N78-17068# ARO, Inc., Arnold Air Force Station, Tenn.
OPTICAL MEASUREMENTS OF NO AND NO SUB 2 IN THE EXHAUST OF AN F101-GE-100 ENGINE AT SIMULATED ALTITUDES Final Report, 12 Jan. 1975 - 1 Apr. 1977
J. D. Few AEDC Dec. 1977 26 p refs
(AD-A047882; ARO-ETF-TR-77-42; AEDC-TR-77-75) Avail: NTIS HC A03/MF A01 CSCL 21/2

Measurements of nitric oxide (NO) and nitrogen dioxide (NO2) concentrations were made in the exhaust of an F101-GE-100 engine using ultraviolet (UV) spectral absorption techniques. The measurements were made at a station 10.2 cm downstream of the engine nozzle exit. The NO measurements were made at two engine power settings, intermediate and maximum afterburning; the NO2 measurement was made only at intermediate power. The line-of-sight absorption measurements through the axisymmetric exhaust stream were converted to local values of concentration via an iterative radial inversion computation. These in situ measurements are compared to NO sub x concentration values obtained by conventional probe sampling techniques using a chemiluminescent analyzer. Author (GRA)

N78-17069# Avco Lycoming Div., Stratford, Conn.
ADVANCED SCAVENGE SYSTEMS FOR AN INTEGRATED ENGINE INLET PARTICLE SEPARATOR Final Report, 21 Mar. 1975 - 21 Mar. 1977
Michael J. Zoccoli Sep. 1977 200 p refs
(Contract DAAJ02-75-C-0026)
(AD-A047872; LYC-77-26; USAAMRDL-TR-77-26) Avail: NTIS HC A09/MF A01 CSCL 21/5

In designing a device which scavenges the gas turbine engine integral particle separator, the fundamental problem is one of providing primarily a durable design that is practical in other important aspects which include, but is not limited to, power consumption, cost, physical size, and noise. An advanced scavenge system for an integrated engine inlet protection system was developed to demonstrate a 50-hour operational capability at a specified minimum performance level in the severe erosion environment typical of conditions at the exit from the engine particle separator. Several alternative configurations were studied; two were selected for detailed design and experimental evaluation. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N78-17070*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FILTERING TECHNIQUE BASED ON HIGH-FREQUENCY PLANT MODELING FOR HIGH-GAIN CONTROL Patent Application
Frank R. Niesson and John F. Garren, Jr., inventors (to NASA)

Filed 8 Dec. 1977 14 p
(NASA-Case-LAR-12215-1; US-Patent-Appl-SN-858762) Avail: NTIS HC A02/MF A01 CSCL 01C

An aircraft control system which utilized feedback motion sensors to generate a control signal to control the aircraft is illustrated. The use of a complementary filter permitted a substantial increase in frequency bandwidth due to the simultaneous reduction in noise amplification and control limit cycle tendencies. NASA

N78-17071# Royal Aircraft Establishment, Farnborough (England).
INFLUENCE OF GUST MODELLING ON THE IDENTIFICATION OF THE DERIVATIVES OF THE LONGITUDINAL MOTION OF AN AIRCRAFT
Gerd Schulz Oct. 1977 34 p refs Transl. into ENGLISH from report DLR-FB 76-63 (West Germany), 1976, DFVLR, Oberpfaffenhofen 34 p
(RAE-Lib-Trans-1944; BR61071) Avail: NTIS HC A03/MF A01

The influence of stochastic modelling of horizontal and vertical gusts on the maximum likelihood identification of derivatives of the longitudinal motion of the HFB-320 aircraft was investigated. Several different modellings of the power spectral densities of the gusts were considered. It was shown that the outputs are more influenced than the estimates of the derivatives. The best curve fit occurred for modelling of the power spectral densities of the gust by a first order Gauss-Markov process. Author

N78-17072# United Technologies Corp., Stratford, Conn. Sikorsky Aircraft Div.
PRELIMINARY DESIGN STUDY OF AN INTEGRATED TAIL ROTOR SERVO POWER MODULE Final Report
Joseph R. Maciolek and Karl Wallischeck Sep. 1977 165 p refs
(Contract DAAJ02-76-C-0056)
(AD-A047678; SER-50798; USAAMRDL-TR-77-20) Avail: NTIS HC A08/MF A01 CSCL 01/3

The purpose of the work performed was to determine the feasibility of generating the hydraulic power required to control the tail rotor pitch of a utility helicopter by locating tail-rotor-driven hydraulic supply systems within the tail rotor servo. This relocation of the hydraulic supply system would eliminate the weight, the cost and the excessive vulnerability of the long hydraulic lines in conventional servo systems. Using the YUH-60 as a design subject, a preliminary design of an integrated servo power module with electrical (fly-by-wire) inputs was performed. This study confirms the advantages of generating the hydraulic power at the tail rotor gearbox. When combined with a fly-by-wire controller, the weight saving for a UTTAS design would be the order of 10 lbs. Compared with the current conventional system, the MTBF of the system would increase by a 7 to 1 factor. Production cost savings could be almost $2000 per aircraft. GRA

N78-17073# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
AIRCRAFT COMPENSATOR DESIGN METHODS M.S. Thesis
Tom Lance Riggs, Jr. Jun. 1977 133 p refs
(AD-A047814; AFIT-CI-77-15) Avail: NTIS HC A07/MF A01 CSCL 20/4

In this paper methods using linear analysis are presented for the design of longitudinal flight compensators. The compensators employ state feedback to force the aircraft to respond in the desired manner. The design process involves analysis of the uncompensated aircraft, construction of a model which has the desired response, and two algorithms for designing the compensator. A method is presented for contriving the desired model from handling qualities performance criteria. The method is straightforward and results in the exact desired short period response; however, the phugoid (long period) response is less predictable. The compensator design algorithms are easily implemented into computer programs. The algorithms require a minimum of human/computer interaction and solutions are assured for controllable systems. Compensators for two aircraft are designed to show the techniques presented. In both examples the compensated system response is exactly the same as the model response. Author (GRA)

N78-17074# Advisory Group for Aerospace Research and Development, Paris (France).
AN INTRODUCTION TO THE PROBLEM OF DYNAMIC STRUCTURAL DAMPING
Paolo Santini (Rome Univ.), Antonio Castellani (Rome Univ.), and Alfonso Nappi (Rome Univ.) Jan. 1978 24 p refs Presented at the 45th Struct. and Mater. Panel Meeting, Voss, Norway, Sep. 1977
(AGARD-R-663; ISBN-92-835-1268-5) Avail: NTIS HC A02/MF A01

Major topics in the area of dynamic damping are described. A list of typical problems where damping is of primary importance is provided. Typical structural components are considered and a brief account on the effect of materials is given. Mathematical models and intermodal coupling are also examined, and the extreme difficulty of obtaining reasonably accurate information from them is emphasized. Possible philosophies of ground tests and flight tests are discussed. Author

N78-17075# Advisory Group for Aerospace Research and Development, Paris (France).
TECHNICAL EVALUATION REPORT ON THE AVIONICS PANEL/GUIDANCE AND CONTROL PANEL JOINT SYMPOSIUM ON AVIONICS/GUIDANCE AND CONTROL FOR REMOTELY PILOTED VEHICLES (RPVs)
Morris A. Ostgaard Dec. 1977 14 p Symp. held at Florence, 3-6 Oct. 1976
(AGARD-AR-113; ISBN-92-835-1264-2) Avail: NTIS HC A02/MF A01

A symposium was held to examine the state-of-the-art in the field of avionics and guidance control related to the problems of remotely piloted vehicles. Some of the following topics were discussed: (1) Electro-optical sensors and their adverse weather capability limitations; (2) Experimental testing of various types of sensors; (3) Sensor requirements for medium range surveillance and target acquisition systems and (4) Data processing data display systems. B.B.

N78-17076# Advisory Group for Aerospace Research and Development, Paris (France).
EFFECTS OF STRUCTURAL NON-LINEARITIES ON AIRCRAFT VIBRATION AND FLUTTER
E. Breitbach (Aerodynamische Versuchsanstalt, Goettingen, West Ger.) Jan. 1978 17 p refs Presented at the 45th Struct. and Mater. Panel Meeting, Voss, Norway, Sep. 1977
(AGARD-R-665; ISBN-92-835-1270-7) Avail: NTIS HC A02/MF A01

The physical sources of various types of nonlinearities were examined and their influence on the different parts of the flutter clearance process was investigated. Methods which permit quantitative solutions of nonlinear aeroelastic problems were also surveyed. Author

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N78-17077# Dunlay (William J., Jr.), Bala Cynwyd, Pa.
AIRPORT IMPROVEMENT TASK FORCE DELAY STUDY: DELAY MODEL VALIDATION PLAN Final Report, 26 Jul. - 18 Aug. 1977
William J. Dunlay, Jr. Washington FAA Aug. 1977 55 p refs
(FAA Order W1-77-2412-1)
(AD-A048112; FAA-EM-77-17) Avail: NTIS HC A04/MF A01 CSCL 01/5

A validation plan was presented for an airside simulation

model. The plan stresses basic principles of validation and inherent problems associated with comparing simulation model delay estimates with observable real-world data. A methodology was proposed that consists of three major steps: (1) evaluation of model logic, inputs, and outputs; (2) comparison of model estimates with collected data; and (3) a sensitivity analysis of the delay simulation model. A Model Validation Group, established to oversee the validation process, was described. Suggestions were given on sources of data on airside operations for model inputs and for comparisons with model estimates. Author

N78-17078# Stanford Research Inst., Menlo Park, Calif.
PILOTED FLIGHT SIMULATOR STUDY OF LOW-LEVEL WIND SHEAR, PHASE 1 Interim Report, Jun. 1975 - Jul. 1976
Walter B. Gartner and A. Charles McTee May 1977 72 p refs
(Contract DOT-FA75WA-3650; SRI Proj. 4364)
(AD-A047985; FAA-RD-77-166) Avail: NTIS
HC A04/MF A01 CSCL 01/4

A piloted flight simulation was conducted to evaluate the need for improved cockpit displays and procedures for aiding airline pilots in anticipating and coping with the effects of low-level wind shear. Pilot and aircraft response to the shear encounter under 'baseline' conditions was determined using existing cockpit displays and approach management procedures, and the improvement that might be realized from various ways of augmenting the information available to the pilot for wind-shear detection and flight control was evaluated. The results indicate that pilots would not be able to successfully cope with the more severe frontal and thunderstorm shears using existing flight instruments and procedures. All of the aiding concepts evaluated provided some useful information for alerting the pilot to a potential shear and for indicating the effects of the shear during the encounter. However, pilot preferences were strongly in favor of a display of ground speed integrated with the airspeed indicator. Author

N78-17079# Naval Air Propulsion Test Center, Trenton, N.J. Propulsion Technology and Project Engineering Dept.
EVALUATION OF THE EXTENDED USE OF FERROCENE FOR TEST CELL SMOKE ABATEMENT ENGINE AND ENVIRONMENTAL TEST RESULTS Interim Report
Anthony F. Klarman Oct. 1977 126 p refs
(AD-A047659; NAPTC-PE-110) Avail: NTIS
HC A07/MF A01 CSCL 21/4

Results of a test program to evaluate the feasibility of utilizing the smoke suppressant fuel additive, ferrocene, during post overhaul performance checks of gas turbine engines at Naval Air Rework Facilities (NARF's) and other lower level maintenance test facilities to reduce test cell exhaust smoke plumes to environmentally acceptable levels are presented. This test program was conducted on the following gas turbine engines: J52-P-6B, J57-P-10, J79-GE-8D, TF30-P-6C and TF41-A-2A.
Author (GRA)

N78-17080# Vehicle Systems Development Corp., Upland, Calif.
HELICOPTER GROUND MOBILITY SYSTEM (HGMS) CONCEPT FORMULATION AND SELECTION Final Technical Report, 29 Jun. 1976 - 20 Jun. 1977
R. W. Forsyth and J. P. Forsyth Sep. 1977 94 p refs
(Contract DAAJ02-76-C-0037; DA Proj. 1F2-62209-AH-76)
(AD-A047507; USAAMRDL-TR-77-35) Avail: NTIS
HC A05/MF A01 CSCL 01/3

The first task resulted in the definition of some 30 ground mobility system concepts, including wheeled and tracked, frame-type transporters, auxiliary wheel systems, all-wheel-drive prime movers, and two-element, articulated mover systems designed for load transfer from the helicopter. In Task 2, the contractor developed evaluation criteria and conducted a preliminary analysis of the suitability of the various concepts for the mission of providing local ground mobility for the AAH and UTTAS helicopters in unimproved terrain. The third task involved the preparation of prototype design layouts of the selected concept, a four-wheeled, two-element, articulated prime mover, with provisions for offloading the tail wheel of the helicopter for weight transfer, and controls for a walking operator. With tractive effort provided by this, the flotation required for the helicopter is achieved by temporarily attaching tracks on the main landing gear of the helicopter. Additionally, under Task 3, the contractor prepared the system specification for the HGMS. The program effort was concluded with Task 4, which involved the development of a concept design and preliminary layout drawings for the adapter unit enabling use of the HGMS with skid-equipped helicopters.
GRA

N78-17081# Developmental Sciences, Inc., City of Industry, Calif.
ALTERNATE AQUILA RECOVERY SYSTEM DEMONSTRATION: RECOVERY SYSTEM FLIGHT TESTS Final Report, Jul. - Nov. 1976
K. Phillips 19 Jan. 1977 66 p Original contains color illustrations
(Contract DAAJ02-76-C-0039)
(AD-A047429; Rept-13160-RSFT) Avail: NTIS
HC A04/MF A01 CSCL 01/5

DSI, Inc., was contracted to develop an alternate recovery system to the Lockheed AQUILA system-arresting hook and cable. A vertical net with disk brake and horizontal air bag was developed and successfully tested using the Sky Eye RPV as a test vehicle at weights up to 150 pounds. This report documents design selection and test data. Author (GRA)

N78-17082# Appli-Mation, Inc., Orlando, Fla.
INSTRUCTOR PILOT'S ROLE IN SIMULATION TRAINING, PHASE 2 Final Report, Mar. 1976 - May 1977
John P. Charles Aug. 1977 59 p refs
(Contract N61339-76-C-0034)
(AD-A047919; NAVTRAEQUIPC-76-C-0034-1) Avail: NTIS
HC A04/MF A01 CSCL 05/9

Analyses of Instructor Pilot functions in training pilots using simulation were performed. The functions were based on the review of current simulation training conducted in the Phase I study NAVTRAEQUIPCEN 75-C-0093-1 (AD-A023 546). Feasible allocations of functions were made and modular implementation concepts developed. GRA

N78-17083# Naval Training Equipment Center, Orlando, Fla.
PROCEEDINGS OF 10TH NTEC/INDUSTRY CONFERENCE: RESOURCE CONSERVATION THROUGH SIMULATION Final Report
G. Vincent Amico Nov. 1977 365 p refs Conf. held at Orlando, Fla., 15-17 Nov. 1977
(AD-A047905; NAVTRAEQUIPC-IH-294) Avail: NTIS
HC A16/MF A01 CSCL 05/2

This report is a compilation of papers on a variety of technical and training subjects related to training device technology and training methodology. Representatives include sponsors, users, research, development, and procurement agencies and industry. The papers in this report were presented at the tenth NTEC/ Industry Conference held 15 - 17 November 1977. The conference theme, 'Resource Conservation Through Simulation,' focuses attention on the multiple benefits that accrue through simulation. Simulation provides the technological base for training equipment. Through simulation, it is possible to bring that portion of the real tactical world into the classroom to support training needs. The classroom provides an effective and controlled environment for the individual and team learning experience. The utilization of training equipment results in substantial savings in resources. The tenth Conference is part of a continuing program to promote cooperation between Government and industry in the development of effective training equipment, and foster an exchange of new ideas in simulation technology. GRA

N78-17084# Naval Weapons Support Center, Crane, Ind.
AN EXAMINATION OF SELECTED DIGITAL FLIGHT GENERATORS Final Report, May 1974 - Dec. 1975
D. K. Sanders and N. L. Papke Nov. 1977 49 p refs Sponsored by Joint Tech. Coordinating Group for Aircraft Survivability
(AD-A047845; JTCG/AS-77-S-001) Avail: NTIS
HC A03/MF A01 CSCL 09/2

This report describes the findings of an investigative analysis of four flightpath generation computer models. The four models (FAIR PASS, FLYGEN, BLUE MAX and MCEP) are commonly used in the aircraft survivability/vulnerability community. The first three are primarily fixed-wing models, while MCEP is exclusively

a rotary-wing flightpath generator. All four models were acquired, installed, tested, and analyzed at NWSC (Naval Weapons Support Center), Crane, IN. Criteria such as capabilities, limitations, ease and economy of use, and compatibility with attrition models were considered in the evaluations. Author (GRA)

N78-17085# Rome Air Development Center, Griffiss AFB, N.Y.
THE F-111 POSITIONAL ERROR ANALYSIS WHEN MOUNTED ON 3 AXIS POSITIONER AT RADC NEWPORT TEST ANNEX Technical Report, Mar. 1975 - Dec. 1976
William J. Bocchi Oct. 1977 83 p refs
(AD-A047855; RADC-TR-77-299) Avail: NTIS HC A05/MF A01 CSCL 01/3

This report describes the procedures that were used to determine the true orientation of the F-111 aircraft mounted on the Scientific-Atlanta, Inc. three-axis positioner, model PAEA-85. The report describes the following aspects of this effort: (1) Establishment of the reference coordinate system for the aircraft and alignment of aircraft on pedestal, (2) Development of an inclinometer measurement system for determining aircraft orientation and for estimating errors associated with the aircraft positioning system, (3) Test program for evaluating probable errors in the positioner system, (4) Discussion of results of measurements and evaluation of probable system errors, and (5) Recommendations of procedures to be followed for aircraft alignment and for estimating probable system orientation errors. Author (GRA)

N78-17086# Army Training and Doctrine Command, Fort Monroe, Va.
TRAINING DEVELOPMENT STUDY DIRECTIVE: COST AND TRAINING EFFECTIVENESS ANALYSIS (CTEA) OF THE AH-1 FLIGHT AND WEAPONS SIMULATOR (AH/FS)
23 Sep. 1977 18 p refs
(AD-A047868) Avail: NTIS HC A02/MF A01 CSCL 01/3

The study will be conducted by personnel of the US Army Aviation Center concurrent with and subsequent to the Developmental Test/Operational Test II (DT/OT II) of the AH1FS prototype, which simulates the cockpit configuration and the flight and weapon systems performance of the AH-1Q Cobra helicopter. Data from the test will be used in the training effectiveness analysis. GRA

N78-17087# Fortifikationsfoervaltningen, Stockholm (Sweden).
ON AN EXPLOSIVELY DRIVEN SHOCK TUBE
Hans R. W. Weibull 29 Aug. 1977 35 p refs
(F-103-46) Avail: NTIS HC A03/MF A01

A detonating charge of a high explosive produces a shock wave and hot gases. Pressure, duration, and running time of a shock wave in a closed chamber were computed using a computer program and results were compared with measured values. Pressure and duration of the hot gases were obtained from previously published papers and results were compared with measured values. The methods used to calculate pressure, duration, and running time of shock waves and of hot gases give values which coincide fairly well with measured values. Author (ESA)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N78-17088*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO-SOYUZ TEST PROJECT. VOLUME 1: ASTRONOMY, EARTH ATMOSPHERE AND GRAVITY FIELD, LIFE SCIENCES, AND MATERIALS PROCESSING
1977 570 p refs 2 Vol.
(NASA-SP-412) Avail: NTIS HC A24/MF A01 CSCL 22A

The joint U.S.-USSR experiments and the U.S. conducted unilateral experiments performed during the Apollo Soyuz Test Project are described. Scientific concepts and experiment design and operation are discussed along with scientific results of postflight analysis. For individual titles, see N78-17089 through N78-17119.

N78-17089*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SUMMARY OF SCIENTIFIC RESULTS
R. T. Guila *In its* Apollo-Soyuz Test Proj., Vol. 1 1977 p 1-21 (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 22A

Experiments in space sciences, life sciences, and materials processing performed during the joint Apollo Soyuz Test Project are briefly summarized. Experiment concepts, instrumentation, and operations are discussed along with results of postflight analyses. J.M.S.

N78-17090*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MISSION DESCRIPTION
S. N. Hardee *In its* Apollo-Soyuz Test Proj., Vol. 1 1977 p 23-37 (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 22A

The Apollo spacecraft and the Soyuz spacecraft used for the Apollo Soyuz Test Project are described along with the tracking and communications networks utilized for the mission. The flight is briefly summarized including: launch, rendezvous, and docking maneuvers; crew transfer and joint and unilateral experiments; Soyuz deorbit and landing; and Apollo orbit continuation, deorbit, and landing. J.M.S.

N78-17091*# Naval Research Lab., Washington, D. C.
SOFT X-RAY OBSERVATIONS: EXPERIMENT MA-048
c93
S. Shulman, S. Naranan, W. Snyder (Johns Hopkins Univ.), D. Yentis, R. Cruddace, H. Friedman, G. Fritz, and R. Henry (Johns Hopkins Univ.) *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 39-48 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 03B

Celestial X-ray sources were observed in the energy range from 0.1 to 10 keV. Despite in-flight anomalies encountered in the operation of the experiment, X-ray spectra and fast time variability were measured and regions of enhanced emission in the X-ray background, an X-ray pulsar, and an X-ray emitting supernova remnant were detected. Results of observations of SMC x-1, extended low energy sources, and HZ 43 are briefly summarized. J.M.S.

N78-17092*# California Univ., Berkeley.
EXTREME ULTRAVIOLET SURVEY: EXPERIMENT MA-083
c93
S. Bowyer, B. Margon, M. Lampton, F. Paresce, and R. Stern *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 49-70 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 03B

Nonsolar sources in the extreme ultraviolet (EUV) region of the electromagnetic spectrum (10 to 100 nm) were observed by a grazing incidence telescope flown in the Apollo service module during the Apollo Soyuz Test Project. Ten nighttime orbits were used to obtain data on 30 preselected stars, 1 planet, and the EUV background radiation. Extrasolar EUV sources detected include: the hot white dwarfs HZ 43 and Feige 24, the dwarf nova SS Cygni, and the M-dwarf flare star Proxima Centauri. J.M.S.

N78-17093*# California Univ., Berkeley.
INTERSTELLAR HELIUM GLOW: EXPERIMENT MA-088
c90
S. Bowyer, J. Freeman, M. Lampton, and F. Paresce *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 71-83 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 03B

A four channel photometer sensitive to two solar extreme ultraviolet lines that are resonantly scattered by helium gas was developed to study the properties of the local interstellar medium and the structure of the earth's plasmapause. Observations of the 58.4-nm line of He I, the intensities of the center and wings of that line, and the 30.4-nm line of He II are discussed. Major systems of the helium glow detector are described along with instrument calibration and flight operations. J.M.S.

N78-17094*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ARTIFICIAL SOLAR ECLIPSE: EXPERIMENT MA-148 **c92**
G. M. Nikolskiy (USSR Academy of Sci.), A. I. Simonov (USSR Academy of Sci.), I. S. Kim (USSR Academy of Sci.), R. T. Guila, M. D. Jenness, and A. N. Lunde *In its* Apollo-Soyuz Test Proj., Vol. 1 1977 p 85-99 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 03B

The solar corona was photographed from the Soyuz spacecraft against the black space background while the disk of the sun was occulted by the Apollo spacecraft. The extended region of the solar corona and the distribution of contaminant gaseous and particle atmosphere around the Apollo spacecraft were studied. Operations and equipment and postflight analysis of the photographs are discussed. Scale and shading determination, photographic calibration and production of isophotes, and pattern of corona intensity along the ecliptic are among the topics considered. Conclusions of the preliminary analysis of the ASE experiment are presented. J.M.S.

N78-17095*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CRYSTAL ACTIVATION: EXPERIMENT MA-151
J. I. Trombka, E. L. Eller, R. L. Schmadebeck, C. S. Dyer (Maryland Univ.), R. C. Reedy (LASL), D. W. Barr (LASL), J. S. Gilmore (LASL), R. J. Prestwood (LASL), B. P. Bayhurst (LASL), D. G. Perry (LASL) et al *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 101-107 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 20B

Background radiation attributed to X-ray and gamma ray emission induced in the spacecraft surrounding the detector and within the detector itself was measured in sample packages of metals selected for their cross sections for specific neutron and proton energies and germanium and thallium-activated sodium iodide (NaI(T1)). Analysis of the spectra for noise and resolution characteristics, nondestructive tests and chemical analysis of the metal foil disks after splashdown, and direct and indirect measurement of the induced radionuclides are discussed. Results of internal and external monitoring of the NaI crystal activation spectrum are compared to that of the Apollo 17 crystal. J.M.S.

N78-17096*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ULTRAVIOLET ABSORPTION: EXPERIMENT MA-059 **c74**
T. M. Donahue (Michigan Univ.), R. D. Hudson, W. T. Rawlins (Pittsburgh Univ.), J. Anderson (Michigan Univ.), F. Kaufman (Pittsburgh Univ.), and M. B. McElroy (Harvard Univ.) *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 109-126 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 20F

A technique devised to permit the measurement of atmospheric species concentrations is described. This technique involves the application of atomic absorption spectroscopy and the quantitative observation of resonance fluorescence in which atomic or molecular species scatter resonance radiation from a light source into a detector. A beam of atomic oxygen and atomic nitrogen resonance radiation, strong unabsorbable oxygen and nitrogen radiation, and visual radiation was sent from Apollo to Soyuz. The density of atomic oxygen and atomic nitrogen between the two spacecraft was measured by observing the amount of resonance radiation absorbed when the line joining Apollo and Soyuz was perpendicular to their velocity with respect to the ambient atmosphere. Results of postflight analysis of the resonance fluorescence data are discussed. J.M.S.

N78-17097*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STRATOSPHERIC AEROSOL MEASUREMENTS: EXPERIMENT MA-007 **c46**
T. J. Pepin (Wyoming Univ.), M. P. McCormick, W. P. Chu (Old Dominion Univ.), F. Simon (Wyoming Univ.), T. J. Swissler (Systems and Applied Sciences Corp.), R. R. Adams, K. H. Crumbly, and W. H. Fuller, Jr. *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 127-136 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 04A

Direct solar occultation measurements by photometers and from photographs are used for defining stratospheric aerosol concentrations. Ground truth data provided by laser radar and balloon-borne dustsonde are combined with the remote sensing data from the experiment to investigate the uniqueness of aerosol optical models. The results show a 1.5 times higher peak aerosol concentration in the Northern Hemisphere than in the Southern Hemisphere. Author

N78-17098*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
DOPPLER TRACKING: EXPERIMENT MA-089 **c17**
G. C. Weiffenbach (Smithsonian Astrophysical Obs.), M. D. Grossi (Smithsonian Astrophysical Obs.), and P. W. Shores *In its* Apollo-Soyuz Test Proj., Vol. 1 1977 p 137-175 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 08B

Measuring the gravity field from satellite-to-satellite velocity measurements, ionospheric studies using satellite-to-satellite Doppler data, and analysis of docking module motion about the center of mass are discussed. Other topics considered include: equipment built for the experiment; sources of data; and data reduction techniques. Results of ionospheric observations are presented and the inconclusive search for gravity signatures in the satellite-to-satellite velocity measurements is summarized. J.M.S.

N78-17099*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GEODYNAMICS: EXPERIMENT MA-128 **c46**
F. O. Vonbun, W. D. Kahn, W. T. Wells (Washington Analytical Services Center, Inc., Riverdale, Md.), and T. D. Conrad *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 177-191 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 08G

The feasibility of tracking and recovering high frequency components of the earth gravity field by utilizing a synchronous orbiting tracking station such as ATS 6 was demonstrated. Short wavelength features of the earth gravity field were detected at both data collection points and discretely distributed gravity anomalies were recovered. The problem of recovering the magnitude of the gravity field perturbations that produced the signatures in the experiment data residuals is addressed and the values of the recovered gravity anomalies are compared with surface gravity measurements. Author

N78-17100*# California Univ., Berkeley. Lawrence Radiation Lab.
LIGHT FLASH OBSERVATIONS: EXPERIMENT MA-106 **c52**
T. F. Budinger, C. A. Tobias, R. H. Huesman, F. T. Upham, T. F. Wieskamp (Calif. Univ., Livermore Lawrence Livermore Lab.), J. U. Schott (Frankfurt Univ.), and E. Schopper (Frankfurt Univ.) *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 193-209 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 06P

The frequency, character, latitudinal dependence, and identity of cosmic particles that cause the light flash phenomenon were investigated with emphasis on radiation hazards of long term earth orbiting and interplanetary missions. Measurement of the characteristics of the cosmic particle environment in the vicinity of the eye, measurement of dark adaptation, and continuous onboard accumulation of the light flash observations from astronauts and particle detectors throughout one complete orbit were accomplished. Results are presented and discussed. J.M.S.

N78-17101*# Johann-Wolfgang-Goethe-Universitat, Frankfurt am Main (West Germany).
BIOSTACK 3: EXPERIMENT MA-107
Horst Bucker, M. Delpoux (Toulouse Univ.), S. Fogel (California Univ.), M. Freeling (California Univ.), E. H. Graul (Marburg Univ.), G. Horneck, A. R. Kranz, H. Planel (Toulouse Univ.), W. Ruther (Marburg Univ.), and U. Scheidemann *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 211-226 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 22A

The biological effects of individual high-energy loss (HZE) particles of cosmic radiation and the influence of additional random space flight factors were examined. Emphasis was placed on determining radiation hazards to man on long term space missions and on application to development of appropriate shielding against HZE particles in the design and construction of future space vehicles. Topics discussed include: equipment and procedures, dosimetric data, and biological data. The data are compared with similar space flight experiments on Skylab. Results are summarized. J.M.S.

N78-17102*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ZONE-FORMING FUNGI: EXPERIMENT MA-147 c51
T. D. Rogers (Northrop Services, Inc., Houston, Tex.), M. E. Brower (Northrop Services, Inc., Houston, Tex.), and G. R. Taylor *In its* Apollo-Soyuz Test Proj., Vol. 1 1977 p 227-236 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 06C

Streptomyces levoris was used as an experimental test microorganism to study alternating vegetative mycelial and spore ring periodicity during space flight. Culture methods and materials and in-flight operations for the experiment are described. A decreased growth rate periodicity and development of double spore rings immediately after flight were observed and are attributed to such variables as temperature, nutritional medium, and the physical force factors associated with the launch and recovery process. J.M.S.

N78-17103*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MICROBIAL EXCHANGE: EXPERIMENT AR-002 c51
G. R. Taylor, K. D. Kropp (Northrop Services, Inc., Houston, Tex.), M. R. Henney (Northrop Services, Inc., Houston, Tex.), S. S. Ekblad (Northrop Services, Inc., Houston, Tex.), A. A. Baky (Northrop Services, Inc., Houston, Tex.), T. O. Groves (Northrop Services, Inc., Houston, Tex.), T. C. Molina (Northrop Services, Inc., Houston, Tex.), J. G. Decelle (Northrop Services,Inc., Houston, Tex.), C. F. Carmichael (Northrop Services, Inc., Houston, Tex.), N. J. Gehring (Northrop Services, Inc., Houston Tex.) et al *In its* Apollo-Soyuz Test Proj., Vol. 1 1977 p 237-255 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 06C

Components of the infectious disease process in space flight were evaluated by measuring alterations in three factors: (1) the composition of the microbial populations inhabiting the crewmembers and the spacecraft; (2) the ability of each crewmember's defense mechanism to resist infection; and (3) the ability of certain microorganisms to originate infections. The operational aspects associated with the experiment, the activities of medically important microorganisms recovered from the Apollo and Soyuz crewmembers, and the activities of the major groups of microorganisms recovered from the 10 sample sites of each crewmember are described. Results indicate that: (1) a variety of potential pathogens were recovered from each of the prime and backup crewmembers before and after flight; (2) no disease events were reported; and (3) Candida albicans and Staphylococcus aureus were transferred from one crewmember to another during the flight. Author

N78-17104*# Baylor Univ., Waco, Tex. College of Medicine.
CELLULAR IMMUNE RESPONSE: EXPERIMENT MA-031 c52
B. Sue Criswell and Kathy Cobb *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 257-262 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 06P

The cellular immune response of ASTP crewmembers was studied before and after the flight. Parameters studied were white blood cell concentrations, lymphocyte numbers, B- and T-lymphocyte responsiveness to PHA, pokeweed mitogen, Concanavalin A, and influenza virus antigen. Changes in the responsiveness of peripheral blood lymphocytes to phytohemagglutinin (PHA) occurred in the cellular immune response but no quantitative changes in lymphocytes were noted. Results are compared with lymphocytic changes that were noted during the Skylab mission. Author

N78-17105*# Baylor Univ., Waco, Tex. College of Medicine.
POLYMORPHONUCLEAR LEUKOCYTE RESPONSE: EXPERIMENT MA-032 c52
R. Russell Martin, Glenn A. Warr, Margaret J. Putman, Diane H. Kentor, and Carolinda L. Holleman *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 263-279 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 06P

The possible effects of space flight and weightlessness on polymorphonuclear leukocyte (PMN) function, the body's defense against bacterial infection, were investigated in terms of space flight of long duration. Serial blood samples obtained from crewmembers of the ASTP and normal control subjects were tested for total leukocyte count, differential count, leukocyte migration and chemotaxis, phagocytic ability, and cytoplasmic granules stained for leukocyte acid and alkaline phosphatase. The effects of inhalation of propellant gases by the crewmenbers and the inception of corticosteroid therapy were also studied. No abnormality in PMN function was noted. Results are discussed. J.M.S.

N78-17106*# Baylor Univ., Waco, Tex. College of Medicine.
KILLFISH HATCHING AND ORIENTATION: EXPERIMENT MA-161 c51
H. W. Scheld, A. A. Baky (Northrop Services, Inc., Houston, Tex.), J. F. Boyd (Northrop Services, Inc., Houston, Tex.), V. B. Eichler (Wichita State Univ., Kas.), P. M. Fuller (Louisville Univ., Ky.), R. B. Hoffman, J. R. Keefe (Louisville Univ., Ky.), K. P. Kuchnow (Texas A. and M. Univ., College Station), J. M. Oppenheimer (Bryn Mawr College, Pa.), G. A. Salinas (Northrop Services, Inc., Houston, Tex.) et al *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 281-305 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 06C

The embryonic development and vestibular adaptation in space flight of killfish Fundulus heteroclitus were studied. The experiment package consisted of a series of staged embryos and a series of juvenile fish. The experiment theory, data collection techniques, experiment execution procedures, and postflight analysis are discussed. Results of striped-drum tests, parabolic flight tests, light orientation tests, and otolith tests are presented along with results of microscopic examinations of the embryonic development of the central nervous system, the peripheral vestibular apparatus, the eye, and the cardiovascular system. Development rate under space flight conditions is described. No radical changes in vestibular function and in embryonic development were detected. J.M.S.

N78-17107*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ELECTROPHORESIS TECHNOLOGY: EXPERIMENT MA-011 c25
R. E. Allen, G. H. Barlow (Abbott Labs., Chicago), M. Bier (VA Hospital, Tucson, Ariz.), P. E. Bigazzi (State Univ. of N.Y., Buffalo), R. J. Knox (Univ. of Oreg. Health Sciences Center, Portland), F. J. Michale (Lehigh Univ., Bethlehem, Pa.), G. V. F. Seaman (Univ. of Oreg. Health Sciences Center, Portland), J. W. Vanderhoff (Lehigh Univ., Bethlehem, Pa.), C. J. VanOss (State Univ. of N.Y., Buffalo), W. J. Patterson et al *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 307-334 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 07D

Electrophoretic and isotachophoretic separation of biological cells in the near-zero-g environment of space were demonstrated. Frozen live cells were successfully transported into space, electrophoretic processing was performed, and viable cells were returned to earth. A separation of the three types of fixed red blood cells (rabbit, human, and horse) was accomplished. Human lymphocytes showed no apparent migration. Analysis of the human kidney cells shows electrophoretic separation throughout the entire column with at least four bands of viable cells. The hardware associated with the experiment is described and results of the electrophoretic and isotachophoretic experiments are discussed. Author

N78-17108*# Max-Planck-Institut fuer Biochemie, Martinsried bei Muenchen (West Germany).
ELECTROPHORESIS: EXPERIMENT MA-014 c25

K. Hannig, H. Wirth, and E. Schoen (Messerschmitt Boelkow Blohm GmbH, Munich) *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 335-352 ref (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 07D

Free-flow electrophoresis was used to study the increase in sample flow rate and sample resolution achievable in space and to separate and analyze biological particles, such as living cells, without decreasing their biological activity. The electrophoresis equipment was designed for the separation of four mixtures of biological cells with variable sample flow rates, buffer flow rates, and electric field gradients. Separation quality was assessed by measuring the light from a quartz lamp through the electrophoresis channel and on to a photodiode system. Results of data analysis indicate that: (1) all monitored systems operated correctly during the experiment; (2) the optical system produced a light that was too bright to discern true cell distributions; but (3) final analysis of scientific data by computer processing shows the expected distribution of separated cells. Author

N78-17109*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MULTIPURPOSE ELECTRIC FURNACE: EXPERIMENT MA-010 **c33**
A. Boese, J. McHugh (Westinghouse Research Labs., Pittsburgh), and R. Seidensticker (Westinghouse Research Labs., Pittsburgh) *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 353-365 (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 09C

Modifications made to the Skylab multipurpose electric furnace to meet expectations of performance and reliability for ASTP are described. The system consisted of the furnace, a programmable electronic temperature controller, and a helium rapid cooldown system. Performance of the modified system in space is briefly summarized. J.M.S.

N78-17110*# Oak Ridge National Lab., Tenn.
SURFACE-TENSION-INDUCED CONVECTION: EXPERIMENT MA-041 **c34**
R. E. Reed, W. Uelhoff (Institut fuer Festkoerperforschung, Kernforschungsanlage Juelich, West Germany), and H. L. Adair *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 367-401 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 20D

Ground based and space flight experiments performed to study convection caused by steplike compositional variation in a liquid metal contained in both wetting and nonwetting ampoules are described. Transport mechanisms of gold in liquid lead in unit gravity and microgravity environments are compared with emphasis on stirring effects and diffusion parameters. Results of visual examination of ground based and space flight specimens to determine the extent of oxidation and image processing of the autoradiographs to determine gold concentration as a function of location are presented. It is concluded that the flow phenomenon observed was caused by convection induced by the Marangoni effect. J.M.S.

N78-17111*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MONOTECTIC AND SYNTECTIC ALLOYS: EXPERIMENT MA-044 **c26**
L. L. Lacy and C. Y. Ang *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 403-428 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 11F

The effects of weightlessness on the melting and solidification of two material systems, lead-zinc (Pb-Zn) and aluminum antimonide (AlSb), were investigated. Emphasis was placed on phase segregation effects in low-g for the immiscible binary Pb-Zn and the influences of low-g solidification on the microstructural homogeneity and stoichiometry of the semiconducting compound AlSb. Results for two flight samples, two ground based tested samples, and two prototype tested samples of each material are presented and discussed. J.M.S.

N78-17112*# Massachusetts Inst. of Tech., Cambridge.
INTERFACE MARKING IN CRYSTALS: EXPERIMENT MA-060 **c76**
H. C. Gatos, A. F. Witt, Lichtensteiger, and C. J. Herman *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 429-447 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 20B

The crystal growth and segregation characteristics from the melt in a directional solidification configuration under near zero-g conditions were investigated. A germanium (doped with gallium) system was selected and the interface demarcation technique was incorporated into the experiment. It was found that single crystal growth was achieved and that the interface demarcation functioned successfully. Results indicate that convection driven by thermal or surface tension gradients was not present in the melt and that the gallium segregation was fundamentally different in its initial and in its subsequent stages from that in the ground based tests. Author

N78-17113*# Grumman Aerospace Corp., Bethpage, N.Y.
ZERO-g PROCESSING OF MAGNETS: EXPERIMENT MA-070
D. J. Larson, Jr. *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 449-470 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 22A

Contained solidification of high-coercive-strength magnetic materials in the low-g orbital environment was studied. The samples solidified in the low-g environment demonstrated a substantial improvement in the macroscopic chemical homogeneity and exhibit markedly superior magnetic properties. Additional results indicate that in the near absence of the gravitational body force contained fluids will assume a low energy configuration that differs significantly from that found terrestrially. Fluid statics, phase relations and microstructure, and magnetic analysis of the samples are among the topics discussed. Author

N78-17114*# Rensselaer Polytechnic Inst., Troy, N. Y.
CRYSTAL GROWTH FROM THE VAPOR PHASE: EXPERIMENT MA-085 **c76**
H. Wiedemeier, H. Sadeek, F. C. Klaessig, M. Norek, and R. Santandrea *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 471-490 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 20B

The effects of microgravity forces on the morphology of single crystals of mixed systems and the mass transport rates of these systems were investigated. Vapor transport experiments were performed using three chemical compounds, two transport agents, and one inert gas in one common temperature gradient. The analysis of these experiments is based on a direct comparison of X-ray diffraction, microprobe, scanning electron and optical microscopy, and chemical etching studies of crystals obtained under ground based and microgravity conditions. Results demonstrate improvement in structural and chemical homogeneity, surface morphology, and bulk perfection of the space grown materials compared to ground based specimens and greater mass transport rates in microgravity than predicted by existing transport models. Author

N78-17115*# California Univ., Los Angeles.
HALIDE EUTECTIC GROWTH: EXPERIMENT MA-131 **c27**
A. S. Yue, C. W. Yeh, and B. K. Yue *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 491-500 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 07D

Lithium fluoride fibers, embedded in a sodium chloride matrix, were produced in a space environment and in ground based experiments. The absence of vibration and convection currents in the liquid during solidification in the space experiment attributed to the production of continuous fibers in the eutectic mixture. The interfiber spacing of the LiF fibers was calculated and the transmittance was measured as a function of wavelength for the space grown and Earth grown ingots. The space grown eutectics exhibited improved optical properties over the earth grown eutectics. Author

N78-17116*# Academy of Sciences (USSR), Moscow.
MULTIPLE MATERIALS MELTING (METALS): PART OF EXPERIMENT MA-150 **c26**

L. I. Ivanov, V. N. Kubasov, V. N. Pimenov, K. P. Gurov, E. V. Demina, U. S. Malkov, and V. M. Lazarenko *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 501-538 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 11F

The effects of microgravity on the metallurgical synthesis of compound materials were studied. Ground based and space flight experiments were performed to determine: (1) the feasibility of a metallurgical method of synthesizing compound materials with a predetermined distribution of constituents based on metals with significantly different specific gravities; (2) the mutual diffusion and formation of intermetallic phases as a result of interaction of a meltable matrix aluminum (Al) and hard, refractory inclusions tungsten (W); (3) the melting and solidification of powdered Al; and (4) melting and solidification of copper aluminum (CuAl) eutectic alloy as it interacts with Al, as well as on the diffusion and formation of intermetallic phases in the tertiary system of solid, solid rhenium (Re), and liquid Al. Electron scanning microscopy and X-ray spectral analysis were used to examine the ground based and space flight ampoules and ingots. Results are presented and discussed. J.M.S.

N78-17117*# Academy of Sciences (USSR), Moscow.
MULTIPLE MATERIALS MELTING (GERMANIUM-SILICON SOLID SOLUTIONS): PART OF EXPERIMENT MA-150 **c24**
V. S. Zemskov, V. N. Kubasov, I. N. Belokurova, A. N. Titov, I. L. Shulpina, V. I. Safarov, and N. B. Guseva *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 539-553 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 11D

Ground based and space flight experiments on melting and directional crystallization of an antimony (Sb) doped germanium (Ge) silicon (Si) solid solution were performed to study the possibility of using microgravity conditions for obtaining solid solution monocrystals with uniformly distributed components. The results of the preliminary examination of the macrostructure of all crystals obtained under both normal gravity and microgravity conditions are summarized. Silicon distribution, antimony distribution, and crystal structure are among the factors discussed. Conclusions are given. J.M.S.

N78-17118*# Rockwell International Science Center, Thousand Oaks, Calif.
CRYSTAL GROWTH: EXPERIMENT MA-028 **c76**
M. D. Lund *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 555-562 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 20B

Single crystals of insoluble substances were grown in zero-g by allowing two or more reactant solutions to diffuse toward each other through a region of pure solvent. Under zero-g conditions convection and sedimentation are eliminated and diffusion controls the crystal growth process. Excessive nucleation and contamination of the crystals are suppressed. Results indicate that crystals of improved quality and size were produced, but that more precise temperature control and longer growth times are needed to further suppress nucleation. A better understanding of crystal growth theory was achieved. J.M.S.

N78-17119*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RECOVERY OF ATMOSPHERIC PARAMETERS FROM RADIO TRACKING DATA OF THE GEODYNAMICS EXPERIMENT, APPENDIX A **c46**
P. E. Schmid and S. Rangaswamy (Old Dominion Systems, Inc., Gaithersburg, Md.) *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 563-569 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 08N

Doppler tracking data, as measured by the Applications Technology Satellite 6 are studied in terms of lower atmosphere effects. The biasing effects of the troposphere and the ionosphere on radio tracking data and algorithms that remove atmospheric effects from radio and laser tracking data are included. Doppler tracking data measured during occultation between a near-earth and a synchronous satellite are used to deduce atmospheric pressure and temperature profiles on a worldwide basis. Results of this atmospheric analysis that have potential widespread application in the field of meteorology are presented along with computational techniques. J.M.S.

N78-17120*# ECON, Inc., Princeton, N. J.
BENEFIT EVALUATION OF SPACE PROCESSING OF BIOLOGICAL MATERIALS **Final Report**
Dec. 1977 192 p refs
(Contract NAS9-15338)
(NASA-CR-151625; ECON-77-271-2) Avail: NTIS HC A09/MF A01 CSCL 06C

A rational analytical basis for the evaluation of potential benefits of space processing of biological materials is described. A preliminary evaluation of three candidate space processed biological materials was accomplished. Materials investigated were human lymphocytes, urokinase, and Beta cells. Separation of lymphocyte groups was considered in order to improve the matching of donors and recipients for kidney transplantation, while urokinase was examined in regard to treatment of thromboembolic diseases. Separation of Beta cells was studied since it could provide a highly effective means for the treatment of juvenile-onset diabetes. B.L.P.

N78-17121*# Beckman Instruments, Inc., Anaheim, Calif. Advanced Technology Operations.
BIOPROCESSING FEASIBILITY ANALYSIS **Final Report**
Jan. 1978 40 p refs
(Contract NAS9-15438)
(NASA-CR-151621; FR-1235-101) Avail: NTIS HC A03/MF A01 CSCL 22A

The biology and pathophysiology of the thymus gland is discussed and a clinical procedure for thymic hormone assay is described. The separation of null lymphocytes from mice spleens and the functional characteristics of the cells after storage and transportation were investigated to develop a clinical procedure for thymic hormone assay, and to determine whether a ground-based approach will provide the desired end-product in sufficient quantities, or whether the microgravity of space should be exploited for more economical preparation of the hormone. A.H.

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N78-17122 Michigan Univ., Ann Arbor.
OPTIMAL EXPLICIT GUIDANCE DESIGN WITH APPLICATION TO SPACE SHUTTLE RE-ENTRY **Ph.D. Thesis**
Roger Allen Metzler 1977 153 p
Avail: Univ. Microfilms Order No. 77-26314

Optimization techniques are identified which can be included as an integral part of the design of explicit guidance systems. The control vector, in general, is a function of time, vehicle state, and a vector of parameters. The optimization techniques are utilized toward the ultimate goal of selecting component values of the parameter vector. The guidance and navigation functions are separated and the guidance system is designed as a deterministic system. An optimal control algorithm tests the ability of the control to accomplish the design objectives, while a parameter optimization algorithm calculates the optimal parameter vector for a representative number of experimental conditions. Dissert. Abstr.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

No abstracts in this category.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N78-17123* National Aeronautics and Space Administration, Washington, D. C.
NASA FACTS: VOYAGER
[1977] 11 p refs
(NASA-NF-87/10-77) Avail: SOD HC $0.70
CSCL 22A

A news release on NASA's Voyager project is presented. The spacecraft, science instrumentation, experiments and a mission profile are described. A drawing identifying Voyager's major components and instrumentation was included along with diagrams showing the path of Voyager 1 (JST trajectory) past Jupiter, and the path of Voyager 2 (JXT trajectory) during its encounter with Jupiter. An exercise for student involvement was also provided. B.B.

N78-17124*# AEC-ABLE Engineering Co., Inc., Goleta, Calif.
CONCEPTUAL ANALYSES OF EXTENSIBLE BOOMS TO SUPPORT A SOLAR SAIL Final Report
R. F. Crawford and M. D. Benton 20 Oct. 1977 82 p
(Contracts NAS7-100; JPL-954700)
(NASA-CR-155615; AECR-7715/1064) Avail: NTIS HC A04/MF A01 CSCL 22B

Extensible booms which could function as the diagonal spars and central mast of an 800 meter square, non-rotating Solar Sailing Vehicle were conceptually designed and analyzed. The boom design concept that was investigated is an extensible lattice boom which is stowed and deployed by elastically coiling and uncoiling its continuous longerons. The seven different free-span lengths in each spar which would minimize the total weights of the spars and mast were determined. Boom weights were calculated by using a semi-empirical formulation which related the overall weight of a boom to the weight of its longerons.
Author

N78-17125*# ILC Industries, Inc., Frederica, Del.
PRELIMINARY DESIGN AND FABRICATION ASSESSMENT FOR TWO SOLAR SAIL CANDIDATES Final Report
Ralph Weis 1 Jul. 1977 112 p Sponsored by NASA Prepared for JPL
(Contract JPL-954720)
(NASA-CR-155616; Doc-0003-70065) Avail: NTIS HC A06/MF A01 CSCL 22B

Primary emphasis is directed to the spinning sail design and fabrication assessment. Several methods of fabricating the spinning sail blades are presented and compared. Evaluations are made of each proposed design, as well as the baseline design. These efforts resulted in the recommendation of an apparent optimum design and fabrication plan with an assessment of the major advantages/disadvantages of each concept considered. Author

N78-17126*# ILC Industries, Inc., Frederica, Del.
PRELIMINARY DESIGN AND FABRICATION ASSESSMENT Final Report
5 Aug. 1977 39 p Supplement to NASA-CR-155616; Doc-0003-70065: See N78-17125 Sponsored by NASA Prepared for JPL
(Contract JPL-954720)
(NASA-CR-155617; Doc-0003-70065-Suppl) Avail: NTIS HC A03/MF A01 CSCL 22B

Supplemental information is provided on sail design criteria for a square solar sail candidate. A handling and fabrication plan is also offered. Author

N78-17127*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PURGING OF A TANK-MOUNTED MULTILAYER INSULATION SYSTEM BY GAS DIFFUSION
Irving E. Sumner Jan. 1978 59 p refs
(NASA-TP-1127; E-9286) Avail: NTIS HC A04/MF A01 CSCL 22B

The investigation was conducted on a multilayer insulation (MLI) system mounted on a spherical liquid hydrogen propellant tank. The MLI consisted of two blankets of insulation each containing 15 double-aluminized Mylar radiation shields separated by double silk net spacers. The gaseous nitrogen initially contained within the MLI system and vacuum chamber was purged with gaseous helium introduced both underneath the MLI and into the vacuum chamber. The MLI panels were assumed to be purged primarily by means of gas diffusion. Overall, test results indicated that nitrogen concentrations well below 1 percent could be achieved everywhere within the MLI system. Typical times to achieve 1 percent nitrogen concentration within the MLI panels ranged from 69 minutes at the top of the tank to 158 minutes at the bottom of the tank. Four space-hold thermal performance tests indicated no significant thermal degradation of the MLI system had occurred due to the purge tests conducted. The final measured heat input attributed to the MLI was 7.23 watts as compared to 7.18 watts for the initial baseline thermal performance test. Author

N78-17128*# Management and Technical Services Co., Beltsville, Md.
THE NIMBUS 6 DATA CATALOG. VOLUME 7: 1 JULY - 31 AUGUST 1976. DATA ORBITS 5156 - 5985
Oct. 1977 349 p refs
(Contract NAS5-23740)
(NASA-CR-155898) Avail: NTIS HC A15/MF A01 CSCL 22A

Operations of various experiments during the reporting period are summarized. Orbital elements, data availability times, anomalies in the data, geographic location, and time of data are tabulated. Montages obtained by infrared and microwave radiometers are included. A.H.

N78-17129*# Management and Technical Services Co., Beltsville, Md.
THE NIMBUS 6 DATA CATALOG. VOLUME 8: 1 SEPTEMBER - 31 OCTOBER 1976. DATA ORBITS 5986 - 6802
Nov. 1977 326 p refs
(Contract NAS5-23740)
(NASA-CR-155899) Avail: NTIS HC A15/MF A01 CSCL 05B

For abstract, see N78-17128.

N78-17130*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE DOPPLER DATA PROCESSING USING A MICROCOMPUTER
P. E. Schmid and J. J. Lynn (Old Dominion Systems, Inc., Gaithersburg, Md.) Dec. 1977 62 p refs Submitted for publication
(Contract NAS5-23587)
(NASA-TM-78046) Avail: NTIS HC A04/MF A01 CSCL 22A

A microcomputer which was developed to compute ground radio beacon position locations using satellite measurements of Doppler frequency shift is described. Both the computational algorithms and the microcomputer hardware incorporating these algorithms were discussed. Results are presented where the microcomputer in conjunction with the NIMBUS-6 random access measurement system provides real time calculation of beacon latitude and longitude. Author

N78-17131*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE SITUATION REPORT, VOLUME 17, NO. 6
31 Dec. 1977 114 p
(NASA-TM-79345) Avail: NTIS HC A06/MF A01 CSCL 05B

Space objects in orbit are listed as well as those which decayed during this reporting period. Data provided include international designation and catalog number, nation of source, launch data, inclination, and apogee and perigee. Transmitting frequencies for satellites being monitored by NASA space flight tracking and data network are given. Author

N78-17132# Air Force Weapons Lab., Kirtland AFB, N. Mex.
LAUNCH: A COMPUTER CODE FOR DETERMINING LAUNCH VEHICLE RELIABILITY Final Report
Marcia A. Thornton Sep. 1977 81 p refs
(AD-A047394; AD-E200042; AFWL-TR-77-126) Avail: NTIS MF A01 CSCL 22/4

The computer code, LAUNCH, is designed to maintain a data file on the launches of major launch vehicles. From this data file one can obtain a chronological history of any desired vehicle or group of vehicles as well as the historical reliability and/or projected reliability for any future launch. A discussion of the code and its applications are included along with a listing of the program and a sample output results. Author (GRA)

N78-17133# European Space Agency, Paris (France).
STUDY OF A DRAG-FREE SATELLITE ORBIT CONTROL
Huu Thanh Huynh, Anne-Marie Mainguy, Christian Marchal, and Jean-Pierre Marec Nov. 1977 135 p refs Transl. into ENGLISH of 'Etude d'un Satellite de Navigation a Trainee Compensee. Controle d'Orbite', ONERA, Paris Report ONERA-NT-1976-11, 1976 Original report in FRENCH previously announced as N78-14086
(ESA-TT-429; ONERA-NT-1976-11) Avail: NTIS HC A07/MF A01

Theoretical problems pertaining to the control of a pre-established orbit are considered. The analysis of the orbital motion was performed with regard to the evaluation of the orbital perturbations due to the drag compensation system and errors in the earth potential mode. A trajectography study was carried out for the preoperational phase with a view to determining a locally improved model of the earth potential then, during the operational phase, to observing the satellite position departure from ephemerides. Two correction procedures are proposed in a slow and fast mode. From the results it is possible to foresee the feasibility of an economical control system capable of ensuring that the satellite will follow within 25 m ephemerides suitably established for periods of 30 days ahead. ESA

N78-17134# Reusser (Peter U.) A.G., Zurich (Switzerland).
MODIFICATION OF THE LOUVER ACTUATOR SYSTEM DEVELOPED UNDER ESTEC CONTRACT NO. 1550/71-HP Final Report
Peter U. Reusser and Juerg Meister Paris ESA Mar. 1977 133 p refs
(Contract ESTEC-2276/74-HP)
(ESA-CR(P)-961) Avail: NTIS HC A07/MF A01

The prototypes of a thermal actuator for a lower array were developed and tested. The actuator is based on a tank-bourdon tube system with BeCu spirals. Performance tests of the first design showed that spirals developed cracks, attributed to the forming tool. The use of a new forming tool (second design), however, introduced problems relating to a longer linear pressure range, associated with an overtemperature, and necessitated the introduction of an overpressure compensation either by bellows or by override coupling. Both types of actuators were built and tested, and performed well. ESA

N78-17135# Engins Matra, Velizy (France). Space Div.
APPLICATION OF A ONE DEGREE OF TRANSVERSE FREEDOM SYSTEM TO THE ATTITUDE CONTROL OF AN OPERATIONAL ARIANE LARGE SATELLITE
J. Broquet and B. Govin [1977] 8 p refs
Avail: NTIS HC A02/MF A01

From a brief introduction on the candidate attitude control systems for a geostationary satellite requiring a very high pointing accuracy, the application of the following to an operational Ariane large satellite is presented: one degree of transverse freedom system, radio frequency sensor, programmable control electronics, and magnetic coils. Special emphasis is placed on system capability in terms of accuracy. The optimization of the system for normal mode, station keeping mode, and reacquisition operation is described in some detail for the case of a 1.5 kW satellite. Typical results of simulation are shown for the operational phase. Author (ESA)

N78-17136# Engins Matra, Velizy (France).
ATTITUDE CONTROL LAWS IMPLEMENTATION USING PROGRAMMABLE DIGITAL CONTROLLERS. STUDY AND DEVELOPMENT ASPECTS
R. Havas [1977] 13 p refs
Avail: NTIS HC A02/MF A01

Some aspects of the implementation of attitude control laws algorithms on programmable digital controllers (PDC) are presented. A review of the synthesis techniques for digital filters is the point of major interest. Four digitalization techniques - the standard Z-transform, the bilinear transform, and 2 space state representations - are reviewed. The main filter structures - direct, parallel, cascade, multirhythm, and nonrecursive - are presented. The effect of finite length words filter coefficients is studied and methods for ensuring the stability are proposed. Overflow problems for the fixed point arithmetics are mentioned. An attempt is made to define the physiognomy of the development of an AOCS flying PDC's. Author (ESA)

N78-17137# Engins Matra, Velizy (France). Space Div.
SATELLITE DESIGN ASPECTS OF APPLYING ELECTRIC PROPULSION FOR GEOSTATIONARY SATELLITES
J. Broquet and P. Luquet [1977] 9 p refs
Avail: NTIS HC A02/MF A01

Electrical propulsion has long appeared an attractive technology for reducing the propellant mass required for the NS orbital control of geostationary satellites. The high complexity of electrical propulsion components leads to the concept of integrated electric propulsion packages (EPP's). Satellite geometrical limitations constrain these packages to be implemented on both east and west sides of the satellite in such a way that they must be operated simultaneously to perform north south station keeping. The high peak power requirement during thrusting theoretically imposes a very significant penalty on the solar array sizing. Fortunately, optimized orbital control strategy based on EPP flexibility and on the variation of the solar generator power delivery during the satellite lifetime allows this penalty to be minimized. The very long duration of station keeping maneuvers and low disturbance renders especially attractive the use of a one or two degrees of transverse freedom attitude control system and imposes a new optimization of the yaw sensing. Author (ESA)

N78-17138# Engins Matra, Velizy (France).
MULTIPLE-MICROPROCESSOR SYSTEMS IN ATTITUDE AND ORBIT CONTROL SUBSYSTEMS
J. Soubirou [1977] 7 p
Avail: NTIS HC A02/MF A01

Multiple-microprocessor systems designed to mechanize the signal and data processing functions of the attitude and orbit control subsystems (AOCS) are discussed. As a result of a survey of AOCS processing and data handling tasks, multiprocessor architectures of MIMD type (centralized and distributed) were reviewed and classified depending on the redundancy concept and efficiency. The very large spectrum of mission requirements calls for modular programmable control electronics capable of evolving from minimum to complex systems. Author (ESA)

N78-17139# Engins Matra, Velizy (France).
CLOSED LOOP TEST PHILOSOPHY IN AOCS DEVELOPMENT AND INTEGRATION
R. Cau [1977] 6 p
Avail: NTIS HC A02/MF A01

The ongoing and future spacecrafts of ESA are often based on the sophisticated three axis attitude and orbit control subsystem using different technologies. A major problem occurring during the system development is to ensure that the whole subsystem has the expected dynamic behavior, once integrated in the spacecraft. The aim of a test policy is to provide an answer to this problem. An efficient test method should ensure the AOCS

operates in a realistic dynamic and kinematic way. A good choice is a compromise between purely static test using all equipment assembled onboard, the satellite motion being simulated on an external computer, and a complete three axis simulation table, which is a sophisticated solution. The configuration using a one axis air bearing table combinated with an IR stimuli controlled in a transverse direction was selected for OTS and MAROTS development, together with a test sequence in two steps.
Author (ESA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

No abstracts in this category.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

N78-17140* National Aeronautics and Space Administration, Washington, D. C.
SYSTEM AND METHOD FOR TRACKING A SIGNAL SOURCE Patent
Louis N. Mogavero, Edwin G. Johnson, John M. Evans, Jr., and James S. Albus, inventors (to NASA) Issued 3 Jan. 1978 7 p Filed 11 Jul. 1975 Supersedes N75-30385 (13 - 21, p 2655)
(NASA-Case-HQN-10880-1; US-Patent-4,067,015; US-Patent-Appl-SN-595254; US-Patent-Class-343-225; US-Patent-Class-325-66; US-Patent-Class-325-118; US-Patent-Class-343-112R; US-Patent-Class-362-269) Avail: US Patent Office CSCL 17F

A system for tracking moving signal sources is disclosed which is particularly adaptable for use in tracking stage performers. A miniature transmitter is attached to the person or object to be tracked and emits a detectable signal of a predetermined frequency. A plurality of detectors positioned in a preset pattern sense the signal and supply output information to a phase detector which applies signals representing the angular orientation of the transmitter to a computer. The computer provides command signals to a servo network which drives a device such as a motor driven mirror reflecting the beam of a spotlight, to track the moving transmitter. Official Gazette of the U.S. Patent Office

N78-17141# Air Force Avionics Lab., Wright-Patterson AFB, Ohio. Reconnaissance and Weapon Delivery Div.
SPACE OBJECT SEARCH AND DETECTION STUDIES WITH A GROUND-BASED TELEVISION SENSOR Final Report, 1 Jan. - 30 Jun. 1975
Peter L. Manly Aug. 1977 45 p
(AD-A048040; AFAL-TR-75-152) Avail: NTIS HC A03/MF A01 CSCL 17/2

A test facility was constructed for the purpose of evaluating the sensitivity of modern television camera tubes for detection of moving point sources under operating conditions approximating those to be encountered by ground- or space-based optical surveillance sensors in the ADC SPACETRACK Augmentation role. This test facility was very similar to the GEODSS prototype concept later evolved by the MIT Lincoln Laboratory for installation at the Lincoln Laboratory Stallion Test Site, White Sands Missile Range. Results are given for use of the test-bed system, for a period of 50 days, as a quasi-operational sensor patrolling the geosynchronous traffic belt where some 70 spacecraft and their rocket stages are known to be orbiting. Four hundred thirty-seven satellite detections were made, 175 being of near geosynchronous objects. Positional data were taken of 74 of these satellites and reported to the Space Defense Center for comparison with Baker-Nunn photographic data. A simple photometric SOI subsystem was devised to use the EBSICON camera tube as the detector, and signatures of more than 20 satellites recorded. Some of these are reported here. GRA

N78-17142# Air Force Avionics Lab., Wright-Patterson AFB, Ohio. Reconnaissance and Weapon Delivery Div.
THE CANADIAN FORCES/NORAD SATELLITE IDENTIFICATION SENSOR AT ST. MARGARETS Final Technical Report, Sep. 1975 - Aug. 1977
Kenneth E. Kissell and George E. Mavko Sep. 1977 33 p refs
(AD-A048046; AFAL-TR-77-189) Avail: NTIS HC A03/MF A01 CSCL 17/8

A new operational surveillance sensor has been established by NORAD/ADCOM for an electro-optical identification of orbiting spacecraft. The Space Object Identification (SOI) System utilizes the original R and D sensor, reengineered by AFAL to simplify and automate many of its functions. It has been located in the Maritime Provinces in Eastern Canada, operated by the Canadian Forces Air Command. The automation of the test-bed sensor included a novel hybrid control computer, a microprocessor for data logging and recording, timing control of all operational functions (including computer cycling) by an atomic standard and use of celestial reference sources for self-calibration of both the pointing command system and the target signature system. Using existing hardware with special interfaces and software has reduced significantly the cost and acquisition time of this first on-line system. The Canadian optical SOI sensor is described as placed into operation at the Satellite Identification and tracking unit (SITU) at St. Margarets, New Brunswick. GRA

N78-17098*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
DOPPLER TRACKING: EXPERIMENT MA-089
G. C. Weiffenbach (Smithsonian Astrophysical Obs.), M. D. Grossi (Smithsonian Astrophysical Obs.), and P. W. Shores *In its* Apollo-Soyuz Test Proj., Vol. 1 1977 p 137-175 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 08B

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics.*

N78-17143# Aerospace Corp., El Segundo, Calif. Engineering Science Operations.
SOME ASPECTS OF THE DYNAMICS AND STABILITY OF SPINNING FLEXIBLE SPACECRAFT Final Report
R. K. Williamson 12 Sep. 1977 63 p refs
(Contract F04701-76-C-0077)
(AD-A047502; TR-0077(2901-03)-8; SAMSO-TR-77-210)
Avail: NTIS HC A04/MF A01 CSCL 22/2

The hybrid coordinate approach combines discrete coordinates describing the translations and rotations of some bodies or reference frames of the system with distributed or modal coordinates describing the small relative motions of other parts of the system. This approach is illustrated by application to a simplified spinning spacecraft system. The example illustrates many features of flexural systems engaged in spin. The origins of specific terms in the dynamical equations and their anticipated effects on dynamics are discussed. Literal stability criteria for the wobble motions of a simplified spacecraft system are developed. These criteria can be used to duplicate results of

previously published studies involving considerably more sophisticated models as a point of departure. The stability criteria can be of value in preliminary design but are not intended to supplant more detailed followup studies to verify ultimate system stability. Author (GRA)

N78-17144# European Space Agency, Paris (France).
DYNAMIC RESPONSE ANALYSIS OF SPACECRAFT STRUCTURES BASED ON MODAL SURVEY TEST DATA INCLUDING NONLINEAR DAMPING
Manfred Degener Dec. 1977 59 p refs Transl. into ENGLISH of 'Bestimmung der dynamischen Antwort von Ramfahrtstrukturen auf der Grundlage eines Standschwingungsvers. unter Berueck-sichtigung einer nichtlinearen Daempfung', DFVLR, Goettingen, West Ger. Report DLR-FB-77-17, 29 Apr. 1977 Original report in GERMAN previously announced as N78-14092 Original German report available from DFVLR, Cologne DM 29.20
(ESA-TT-431; DLR-FB-77-17) Avail: NTIS HC A04/MF A01

Theoretical and experimental methods to determine the dynamic response of a spacecraft to the loads acting on the structure during launch and mission were compared. As a possible method, the general procedure for dynamic response calculations based on experimental data measured in a modal survey test is presented. Special emphasis is laid on the importance of the nonlinear damping behavior, which must be taken into account in the dynamic response analysis. It is shown that the modal survey test is a good method of measuring nonlinear characteristics. By introducing these data into the calculations, a reliable dynamic response analysis can be performed. The results are illustrated by some examples. Author (ESA)

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N78-17145*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN AND FABRICATION OF A LOW-SPECIFIC-WEIGHT PARABOLIC DISH SOLAR CONCENTRATOR
Carl W. Richter, Arthur G. Birchenough, Gerald A. Marquis, and Thaddeus S. Mroz Jan. 1978 18 p refs
(NASA-TP-1152; E-9339) Avail: NTIS HC A02/MF A01 CSCL 10A

A segmented design and fabrication and assembly techniques were developed for a 1.8 m (6 ft) diameter parabolic concentrator for space application. This design and these techniques were adaptabie to a low cost, mass-produced concentrator. Minimal machining was required. Concentrator segments of formed magnesium were used. The concentrator weighed only 1.6 kg sq m (0.32 lbm/sq ft). Author

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N78-17146# Aerodyne Research, Inc., Bedford, Mass. Applied Sciences Div.
WIND TUNNEL SIMULATION OF HIGH ALTITUDE ROCKET PLUMES
James Stark Draper and James P. Moran 17 Jun. 1977 39 p refs Backup document for AIAA Synoptic scheduled for publication in the Journal of Spacecraft and Rockets in May - Jun. 1978
(Contract F04611-72-C-0063)
(ARI-RR-88) Avail: NTIS HC A03/MF A01

The degree of simulation of high altitude rocket plumes in wind tunnels was examined. Plume scaling and simulation assessment were based on the plume model of Jarvinen and Hill. The hypersonic plume scale was established, and the dominant simulation parameter was identified as a Knudsen number based on stream mean free path and plume scale. Secondary simulation parameters were identified as stream Mach number, engine thermodynamic efficiency, nozzle exit Reynolds number, and ratios of body dimensions to plume scale. Wind tunnel studies of model plumes were assessed to evaluate degree of simulation of high altitude rocket plumes. It is concluded that important flow features of rocket plumes over the entire high altitude regime may be examined in wind tunnel tests, and nearly complete simulation may be achieved in some cases. Author

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N78-17147*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PHASE RELATIONS IN THE Fe-Ni-Cr-S SYSTEM AND THE SULFIDATION OF AN AUSTENITIC STAINLESS STEEL
K. T. Jacob (Calif. Univ., Berkeley), D. Bhogeswara Rao (Calif. Univ. LBL, Berkeley, Calif.), and Howard G. Nelson Dec. 1977 55 p refs
(NASA-TM-78465; A-7309) Avail: NTIS HC A04/MF A01 CSCL 11F

The stability fields of various sulfide phases that form on Fe-Cr, Fe-Ni, Ni-Cr and Fe-Cr-Ni alloys were developed as a function of temperature and the partial pressure of sulfur. The calculated stability fields in the ternary system were displayed on plots of log P sub S sub 2 versus the conjugate extensive variable which provides a better framework for following the sulfidation of Fe-Cr-Ni alloys at high temperatures. Experimental and estimated thermodynamic data were used in developing the sulfur potential diagrams. Current models and correlations were employed to estimate the unknown thermodynamic behavior of solid solutions of sulfides and to supplement the incomplete phase diagram data of geophysical literature. These constructed stability field diagrams were in excellent agreement with the sulfide phases and compositions determined during a sulfidation experiment. Author

N78-17148# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
THE EVALUATION OF POSSIBLE PREDICTION OF PROPERTIES OF MATERIALS OBTAINED IN WEIGHTLESSNESS
R. P. Borovikova, G. E. Ignatjev, I. P. Kazakov, A. S. Okhotin, F. R. Hashimov, V. T. Hryapov, and G. S. Shonin 1977 13 p refs
(PR-327) Avail: NTIS HC A02/MF A01

The problems of predicting the properties of semiconductors fabricated under weightlessness are discussed. The technique of material manufacture in centrifuge is used. The qualitative results of microanalysis carried out by COMECA and the measurements of specific electric conductivity of the semiconductive materials fabricated in centrifuge with overloads 4 G, 7 G, and 12 G are considered. Author (ESA)

24 COMPOSITE MATERIALS

Includes laminates.

N78-17149* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METHOD OF MAKING A COMPOSITE SANDWICH LATTICE STRUCTURE Patent
Marvin D. Rhodes and Martin M. Mikulas, Jr., inventors (to NASA) Issued 20 Dec. 1977 11 p Filed 20 May 1977 Supersedes N77-26242 (15 - 17, p 2233) Division of US Patent Appl. SN-723264, filed 14 Sep. 1976

(NASA-Case-LAR-11898-2; US-Patent-4,063,981; US-Patent-Appl-SN-799024; US-Patent-Class-156-245; US-Patent-Class-156-285; US-Patent-Class-156-289; US-Patent-Class-428-116; US-Patent-Class-428-902; US-Patent-Appl-SN-723264) Avail: US Patent Office CSCL 11D

A lattice type structural panel is described, which utilizes the unidirectional character of filamentary epoxy impregnated composites to produce stiff lightweight structural panels for use in constructing large area panels for space satellites and the like. Official Gazette of the U.S. Patent Office

N78-17150* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

COMPOSITE LAMINATION METHOD Patent

George E. Dickerson, inventor (to NASA) Issued 27 Dec. 1977 7 p Filed 28 Apr. 1977 Supersedes N77-22179 (15 - 13, p 1689)

(NASA-Case-LAR-12019-1; US-Patent-4,065,340; US-Patent-Appl-SN-792067; US-Patent-Class-156-154; US-Patent-Class-156-264; US-Patent-Class-156-286; US-Patent-Class-156-289; US-Patent-Class-156-300; US-Patent-Class-156-306; US-Patent-Class-156-311; US-Patent-Class-264-90; US-Patent-Class-264-157; US-Patent-Class-428-294; US-Patent-Class-428-302; US-Patent-Class-156-285) Avail: US Patent Office CSCL 11D

A process was developed for preparing relatively thick composite laminate structure wherein thin layers of prepreg tapes are assembled, these thin layers are cut into strips that are partially cured, and stacked into the desired thickness with uncured prepreg disposed between each layer of strips. The formed laminate is finally cured and thereafter machined to the desired final dimensions. Official Gazette of the U.S. Patent Office

N78-17151*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

AN OUTGASSING DATA COMPILATION OF SPACECRAFT MATERIALS

William A. Campbell, Jr., Richard S. Marriott, and John J. Park Jan. 1978 181 p refs

(NASA-RP-1014; G7702-F-24) Avail: NTIS HC A09/MF A01 CSCL 11D

Outgassing data derived from tests at 398 K(25 C) or 24 hours in vacuum, were compiled for numerous materials for spacecraft use. The data presented are the total mass loss and the collected volatile condensable materials. The various materials were compiled by likely usage and alphabetically. Author

N78-17152*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ADHESIVE/COHESIVE STRENGTH OF A ZrO2.1-2 w/O Y2O3/NiCrAlY THERMAL BARRIER COATING

Stanley R. Levine 1978 26 p refs Proposed for presentation at the 80th Ann. Meeting of the Am. Ceramic Soc., Detroit, Mich., 6-11 May 1978

(NASA-TM-73792; E-9359) Avail: NTIS HC A03/MF A01 CSCL 11D

The room temperature adhesive/cohesive strength of a 0.05 cm thick ZrO2.12w/oY2O3/0.013 cm thick NiCrAlY thermal barrier coating system (TBC) was investigated. The weakest link was the oxide/NiCrAlY interface region with a strength of 6.2 MN/sq m. The fracture was about half cohesive oxide failure, half oxide/NiCrAlY adhesive failure and 1 percent cohesive NiCrAlY failure. The TBC failed in a similar manner in 950 C tensile and compression tests. The oxide stripped from the TBC had a cohesive strength of 24.6 MN/sq m. The NiCrAlY had a cohesive strength of 25.1 MN/sq m. The NiCrAlY and oxide failed primarily at interparticle boundaries. Author

N78-17153*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THE EFFECTS OF ECCENTRICITIES ON THE FRACTURE OF OFF-AXIS FIBER COMPOSITES

C. C. Chamis and J. H. Sinclair 1978 17 p refs Presented at the 33rd Ann. Conf. of the Soc. of the Plastics Ind. Reinforced Plastics/Composites Inst., Washington, D. C., 7-10 Feb. 1978

(NASA-TM-73826; E-9269-1) Avail: NTIS HC A02/MF A01 CSCL 11D

Finite element analyses were performed to investigate theoretically the effects of in-plane and out-of-plane eccentricities, bending or twisting, and thickness nonuniformity on the axial stress and strain variations across the width of off-axis specimens. The results are compared with measured data and are also used to assess the effects of these eccentricities on the fracture stress of off-axis fiber composites. Guidelines for detecting and minimizing the presence of eccentricities are described. Author

N78-17154*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

MECHANICAL AND PHYSICAL PROPERTIES OF MODERN BORON FIBERS

James A. DiCarlo 1978 20 p refs Proposed for presentation at the 2d Intern. Conf. on Composite Mater., Toronto, 16-20 Apr. 1978; sponsored by the Met. Soc. of AIME

(NASA-TM-73882; E-9494) Avail: NTIS HC A02/MF A01 CSCL 11D

The results of accurate measurements of the modern boron fiber's Young's modulus, flexural modulus, shear modulus, and Poisson's ratio are reported. Physical property data concerning fiber density, thermal expansion, and resistance obtained during the course of the mechanical studies are also given. Author

N78-17155*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THERMAL ENVIRONMENT EFFECTS ON STRENGTH AND IMPACT PROPERTIES OF BORON-ALUMINUM COMPOSITES

H. H. Grimes, R. A. Lad, and J. E. Maisel (Cleveland State Univ., Ohio) 1977 20 p refs Proposed for presentation at the 2d Intern. Conf. on Composite Maters., Toronto, Canada, 16-20 Apr. 1978; sponsored by the Am. Inst. of Mining, Met. and Petrol. Engrs.

(NASA-TM-73885; E-9498) Avail: NTIS HC A02/MF A01 CSCL 11D

Thermal effects on fracture strength and impact energy were studied in 50 volume percent unidirectional composites of 143 and 203 micron boron fibers in 6061 and 1100 aluminum matrices. For 6061 matrix composites, strength was maintained to approximately 400 C in the cyclic tests and higher than 400 C in the static tests. For the 1100 matrix composites, strength degradation appeared near 260 C after cycling and higher than 260 C in static heating. This composite strength degradation is explained by a fiber degradation mechanism resulting from a boron-aluminum interface reaction. The impact energy absorption degraded significantly only above 400 C for both matrix alloys. Thus, while impact loss for the 6061 composite correlates with the fiber strength loss, other energy absorption processes appear to extend the impact resistance of the 1100 matrix composites to temperatures beyond where its strength is degraded. Interrupted impact tests on as-received and thermally cycled composites define the range of load over which the fibers break in the impact event. Author

N78-17156*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

EFFECT OF SHELF AGING ON O-RING MATERIALS

T. E. Wood and W. P. Stone Jan. 1978 19 p

(NASA-TM-78150) Avail: NTIS HC A02/MF A01 CSCL 11J

Commercial O-rings made from 13 different rubber compounds were tested for physical properties after 7 and 12 years of shelf aging. No gross changes were observed in tensile strength, elongation, or compression deflection characteristics. Author

N78-17157*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.

THE TIME-TEMPERATURE BEHAVIOR OF A UNIDIRECTIONAL GRAPHITE/EPOXY COMPOSITE

Y. T. Yeow, D. H. Morris, and H. F. Brinson Feb. 1978 38 p refs

(Grant NsG-2038)

(NASA-CR-155734; VPI-E-78-4) Avail: NTIS HC A03/MF A01 CSCL 11D

A testing program to determine the time-temperature response of undirectional graphite/epoxy materials is described. Short-term creep test results of strip tensile specimen with the load at

various angles to the fiber direction and at various temperature levels are reported. It was shown that the material is elastic at all temperature levels when the fiber is in the load direction. On the other hand, when the load is transverse to the fibers, the viscoelastic response was shown to vary from small amounts at room temperature to large amounts for temperatures in excess of 180 C for other fiber angles, the response was similar to the latter. Author

N78-17158*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
FINITE ELEMENT STRESS ANALYSIS OF IDEALIZED COMPOSITE DAMAGE ZONES Interim Report
David OBrien and Carl T. Herakovich Feb. 1978 153 p refs (Grant NGR-47-004-129)
(NASA-CR-155923; VPI-E-78-6; IR-12) Avail: NTIS HC A08/MF A01 CSCL 11D

A quasi three dimensional finite element stress analysis of idealized damage zones in composite laminates is presented. The damage zones consist of a long centered groove or cutout extending one or two layers in depth from both top and bottom surfaces of a thin composite laminate. Elastic results are presented for compressive loading of four and eight layer laminates. It is shown that a boundary layer exists near the cutout edge similar to that previously shown to exist along free edges. The cutout is shown to produce significant interlaminar stresses in the interior of the laminate away from free cutout edges. The interlaminar stresses are also shown to contribute to failure which is defined using the Tsai-Wu failure criteria. Author

N78-17159# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.
ULTRASONIC NONDESTRUCTIVE TESTING OF COMPOSITE MATERIALS Final Report, 1 Apr. 1976 - 31 Mar. 1977
Wolfgang Sachse and Yih-Hsing Pao Sep. 1977 122 p refs (Grant AF-AFOSR-2992-76)
(AD-A047487; AFOSR-77-1288TR) Avail: NTIS HC A06/MF A01 CSCL 11/4

The dispersion of elastic waves (ultrasonic waves) in fiber-reinforced materials is investigated by experimental and theoretical methods. A dependable continuous-wave-phase-comparison technique is developed along with the method of phase spectrum to determine the dispersion characteristics, and phase and group velocities in composites. Theoretically, the dispersion relation is determined from the analysis of multiple scattering of elastic waves with parallel cylinders. Author (GRA)

N78-17160# Pennsylvania State Univ., University Park. Dept. of Materials Science.
ENVIRONMENTAL EFFECTS UPON TIME-DEPENDENT FRACTURE OF SILICON NITRIDE AND SILICON CARBIDE Final Report, 1 Jun. 1974 - 31 Aug. 1977
Richard E. Tressler 7 Nov. 1977 11 p refs (Contract DAHC04-74-G-0142)
(AD-A047938; ARO-11769.6-MS) Avail: NTIS HC A02/MF A01 CSCL 11/2

The great advantages, in terms of economy and performance, to be gained by using high performance ceramics in applications such as the gas turbine engine have spurred development efforts in the non-oxide ceramic area and in hardware applications. However, relatively little effort has been devoted to examining in detail the factors which may limit lifetimes in the above applications in which long lifetimes have been traditionally demanded. The purpose of this research project was to use a fundamentally based fracture mechanics approach to examine the susceptibility of Si3N4 and SiC ceramics to stress-corrosion in water and various gaseous environments over a range of temperatures. Further, the fundamental mechanism(s) which contribute(s) to the observed slow crack growth were to be elucidated. In addition, an effort was initiated to investigate the mechanism(s) by which molten salt environments may limit strengths and lifetimes of these materials. Author (GRA)

N78-17161# Battelle Inst., Frankfurt am Main (West Germany).
WARM AND COLD FORMING OF BORON FIBER REINFORCED ALUMINUM [WARM- UND KALTVERFORMUNG VON BORFASERVERSTAERKTEM ALUMINIUM]
K. H. Gruenthaler and K. Neumann Bonn DOKZENTBw 1977 80 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVg-FBWT-77-10) Avail: NTIS HC A05/MF A01; DOKZENTBw DM 30

Possible ways of forming sheets and compressor blades made from boron fiber reinforced aluminum alloys are described. The sheet radii depend on sheet thickness, fiber orientation, and the matrix/fiber system composition. In the case of longitudinal fiber orientation, bending radii of interest for technical applications can be obtained only through hot forming at temperatures above 500 C, which often involves damage to the sheets. With cross-ply fiber arrangement or when the fibers are oriented transversely or at an angle of 45 deg to the bending direction radii of about 100 mm and smaller can already be obtained at room temperature. The most favorable forming behavior is shown by metal sheets with boron B4C reinforcing fibers. For boron fiber reinforced aluminum alloy compressor blades, torsion angles up to 25 deg are possible without any significant damage to the material, whereas for bending up and down only small angle variations are feasible. This formability is sufficient for redressing compressor blades. Forming has only a minor effect on the strength of metal sheets or blades. Author (ESA)

N78-17162# Dornier-System G.m.b.H., Friedrichshafen (West Germany).
TRENDS IN THE APPLICATION OF FIBER REINFORCED MATERIAL WITH PLASTIC MATRIX [ANWENDUNGSTECHNISCHE TRENDS FORTSCHRITTLICHER FASERVERBUNDWERKSTOFFE MIT KUNSTSTOFFMATRIX]
H. Ketterl and K. F. Sahm Bonn DOKZENTBw 1977 167 p refs In GERMAN; ENGLISH summary
(Contract T/RF-52/RF-520/51066)
(BMVg-FBWT-77-12) Avail: NTIS HC A08/MF A01; DOKZENTBw DM 40

New developments in composite materials with so-called advanced fibers such as boron, carbon, kevlar 49 (aromatic polyamide), and asbestos fibers are expounded. The essential mechanical and physical properties of fiber reinforced plastics were compiled; present and future applications of these materials are described. Investigations to improve the temperature resistance of the organic matrix are also reviewed. The result of this study is a summary and a discussion of essential future developments especially with a view to military applications including technological and economic aspects. Author (ESA)

N78-17163# Advisory Group for Aerospace Research and Development, Paris (France).
CERTIFICATION PROCEDURES FOR COMPOSITE STRUCTURES
Jan. 1978 40 p refs Four papers presented at the 44th Meeting of the Struct. and Mater. Panel of AGARD, April 1977
(AGARD-R-660; ISBN-92-835-0208-6) Avail: NTIS HC A03/MF A01

The criteria which presently determine the permissible use of composites in production aircraft and the adaptation of an existing framework of aircraft certification practices to the special characteristics of composites were described. Factors involving the scheduling of full-scale static and fatigue tests and their effect on the use of composites were discussed. Static and fatigue design and test loads were studied. Small and large scale element testing was covered. Some of the structural design problems and load/strain criteria were reviewed. Typical procedures governing the development and interpretation of design data, laboratory and flight tests were explained. Author

N78-17117*# Academy of Sciences (USSR), Moscow.
MULTIPLE MATERIALS MELTING (GERMANIUM-SILICON SOLID SOLUTIONS): PART OF EXPERIMENT MA-150
V. S. Zemskov, V. N. Kubasov, I. N. Belokurova, A. N. Titov, I. L. Shulpina, V. I. Safarov, and N. B. Guseva *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 539-553 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 11D

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N78-17164 Florida Univ., Gainesville.
DETECTOR AND OTHER INSTRUMENTAL EFFECTS ON SIGNAL-TO-NOISE RATIO IN GAS AND LIQUID PHASE FLUORESCENCE Ph.D. Thesis
Raymond Patrick Cooney 1977 116 p
Avail: Univ. Microfilms Order No. 77-25921

Several photomultiplier tubes and image devices (image dissector, silicon vidicon, silicon intensified target vidicon, intensified silicon intensified target vidicon, and secondary electron conduction vidicon) were compared theoretically with respect to signal to noise ratio, S/N, in atomic and molecular luminescence spectrometry. Equations describing the S/N for the image devices were developed and compared with the analogous equations for photomultiplier tubes. The equations were then used to calculate S/N for each device under conditions likely to be encountered in analytically important situations. Dissert. Abstr.

N78-17165 Kansas State Univ., Manhattan.
A FLASH HEATER FOR TANTALUM STRIP FLAMELESS ATOMIC ABSORPTION SPECTROSCOPY, PART 1. A POTENTIOSTAT FOR ELECTROCHEMICAL KINETIC STUDIES, PART 2. A TEMPERATURE TRANSDUCER FOR NMR SAMPLE TUBES, PART 3 Ph.D. Thesis
William Edward Ryan 1977 173 p
Avail: Univ. Microfilms Order No. 77-26057

An electrically heated tantalum sample boat through which a current of up to 100A is passed for a fixed interval of time was examined. Equipment for the control of the sample boat was described. A potentiostat for electrochemical kinetic studies which established and maintained a potential between the working electrode and the bulk of the solution was described and constructed. A temperature transducer to monitor temperatures inside a spinning NMR sample tube was constructed. The transducer was mounted on a 5 mm NMR tube and measured temperature with a copper-constantan thermocouple mounted inside the tube. Dissert. Abstr.

N78-17166 Washington Univ., Seattle.
KINETICS OF THERMOCHEMICAL DECOMPOSITION OF HYDROGEN SULFIDE FOR THE PURPOSE OF GENERATING HYDROGEN Ph.D. Thesis
Kenneth Lawrence Johnson 1977 164 p
Avail: Univ. Microfilms Order No. 77-26835

Thermochemical processes considered for hydrogen economy and the desulfurization of coal and crude oil include the formation of an intermediate metallic sulfide by reacting a metallic with hydrogen sulfide at low temperature and the subsequent decomposition of the sulfide at a higher temperature and subatmospheric pressure, in order to recover the metal. Electron microscopy, X-ray diffraction, and a NASA chemical equilibrium program was used to study the reaction kinetics between hydrogen sulfide and a thin bismuth slab, and to determine the extent of the reaction and identify the reaction products. Dissert. Abstr.

N78-17167 Wisconsin Univ., Madison.
ENGINEERING, HEAT AND THERMODYNAMICS: SPECTROSCOPIC INVESTIGATION OF HYDROXYL RADICAL FORMATION IN THE END GASES OF A SPARK IGNITED ENGINE UTILIZING A DYE LASER Ph.D. Thesis
Duane Lewis Abata 1977 322 p
Avail: Univ. Microfilms Order No. 77-19695

Concentrations of the hydroxyl radical present in the non-inflamed end-gases ahead of the flame front in a spark-ignited engine operating under conditions of both normal and knocking combustion were experimentally determined. The validity of an end-gas computer model developed earlier was tested by identifying and following the concentration of the hydroxyl radical and comparing the results with that predicted by the model. A technique was developed that would allow such a concentration measurement to be made in the operating engine. Concentration measurements of the hydroxyl radical present in the end-gases were obtained with the technique of resonance absorption spectroscopy utilizing a broadband-output, frequency-turnable, flashlamp-pumped, organic-dye laser. Dissert. Abstr.

N78-17168 Cincinnati Univ., Ohio.
APPLICATION OF OSCILLATING MIRROR RAPID SCANNING SPECTROMETER TO SIMULTANEOUS MULTIELEMENT MICROWAVE INDUCED PLASMA EMISSION SPECTROMETRY Ph.D. Thesis
Oliver Rose, Jr. 1977 237 p
Avail: Univ. Microfilms Order No. 77-29730

The potential of the rapid scanning spectrometer (RSS) was demonstrated in a preliminary study coupling the spectrometer to a carbon cup vaporization device/microwave induced plasma (MIP) system. Advantages of the RSS included the wide optical range that could be scanned in a single sweep and a large dynamic range as radiation was detected by a photomultiplier tube. The resolution (line half-widths of approximately 4 nm) and the low light throughput limiting the sensitivity needed improvement. The RSS was modified to enhance the light throughput and resolution. The use of a 1P28 photomultiplier tube and a laboratory constructed amplifier improved the signal-to-noise ratio and the slit widths were reduced increasing the resolution. Dissert. Abstr.

N78-17169 Engineering Sciences Data Unit, London (England).
VAPOUR PRESSURES AND CRITICAL POINTS OF LIQUIDS. 11: HETEROCYCLIC NITROGEN COMPOUNDS
Sep. 1977 29 p
(ESDU-77019; ISBN-0-85679-190-3) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $434.50

Values for the saturated vapor pressures of heterocyclic nitrogen compounds are presented in tabular form. All quantities are expressed in SI units, in the case kN/sq m and kelvins. The procedures used to derive the values of vapor pressure are presented. The uncertainties in the values are also presented. The values of vapour pressure given in the tables were obtained by evaluating, for each compound, an equation in the form of a series of Chebyshev polynomials fitted to the data that had been selected and weighted in accordance with a critical assessment of all the data. Author

N78-17170 Cincinnati Univ., Ohio.
HIGH-FIELD THERMAL TRANSPORT COEFFICIENTS OF POTASSIUM Ph.D. Thesis
Peter Jeffery Tausch 1977 135 p
Avail: Univ. Microfilms Order No. 77-29719

The details of the measurement technique used in taking the data on the thermal resistivity at low temperature for zero and nonzero magnetic fields are presented. A linear heat flow method was used in the temperature range 2 - 8K and in magnetic fields up to 9.5T. The semiclassical theory of the magnetoresistance of metals was considered, along with analysis of the data on the Righi-Leduc coefficient, transverse thermal magnetoresistivity and the longitudinal thermal magnetoresistivity. It was possible to define a thermal relaxation time as the ratio of the Righi-Leduc to longitudinal temperature gradients and to use this to determine the transition from the low field to the high field behavior for data analysis. Dissert. Abstr.

N78-17171*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ELECTROCHEMICAL DATA SIGNAL PROCESS AND DISPLAY Patent Application
Judd R. Wilkins and Richard N. Young, inventors (to NASA) Filed 30 Nov. 1977 11 p
(NASA-Case-LAR-11922-1; US-Patent-Appl-SN-856460) Avail: NTIS HC A02/MF A01 CSCL 07D

An electrochemical detection device for detecting microorganisms is described. A standard ph reference electrode and a platinum cathodic electrode are positioned in a countainer with suitable nutrient medium for microbial growth plus the sample to be tested. The two electrodes are connected to

electronic circuitry including an up/down counter which counts up for the first 80 minutes after a test has been initiated. Then the potential between the two electrodes is tracked by the electronic circuitry and after there is a change of 10 mv a signal is sent to the up/down counter to cause it to reverse its count. Thereafter, when there is an additional 20 mv change in the potential between the two electrodes another signal is sent to the up/down counter signalling it to stop. The resulting count on the counter is equal to the length of time for the inoculum to begin the production of measurable amounts of H2 after inoculation. This length of time is indicative of a endpoint.
NASA

N78-17172*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RELEASE OF DISSOLVED NITROGEN FROM WATER DURING DEPRESSURIZATION
R. J. Simoneau 1978 20 p refs To be Presented at the 14th Ann. Meeting of the Southeastern Seminar on Thermal Sci., Raleigh, N. C., 6-7 Apr. 1978
(NASA-TM-73822; E-1411-1) Avail: NTIS HC A02/MF A01 CSCL 07D

Experiments were run to study depressurization of water containing various concentrations of dissolved nitrogen gas, the primary case being room temperature water saturated with nitrogen at 4 MPa. In a static depressurization experiment, water with very high nitrogen content was depressurized at rates from 0.09 to 0.50 MPa per second and photographed with high speed movies. The pictures showed that the bubble population at a given pressure increased strongly with decreasing depressurization rate. Flow experiments were performed in an axisymmetric converging-diverging nozzle and in a two-dimensional converging nozzle with glass sidewalls. Depressurization gradients were roughly 500 to 1200 MPa per second. Both nozzles exhibited choked flow behavior even at nitrogen concentration levels as low as 4 percent of saturated. The flow rates were independent of concentration level and could be computed as incompressible water flow based on the difference between stagnation and throat pressures; however, the throat pressures were significantly different between the two nozzles. Author

N78-17173*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN EXPERIMENTAL INVESTIGATION OF THE CONDENSATION OF SILICATE GRAINS
K. L. Day (Arizona Univ., Tucson) and B. Donn Jan. 1978 17 p refs Submitted for publication
(NASA-TM-78060) Avail: NTIS HC A02/MF A01 CSCL 07D

Amorphous magnesium silicate smoke particles were condensed from hydrogen and argon atmospheres containing Mg and Si0. A wide range of initial compositions were observed but all particles could be recrystallized into forsterite (Mg2Si04), by heating to 1000 C in vacuum. The amount of smoke formed decreased rapidly with temperatures between 300 and 800 K at reactant partial pressures of about 1 torr. Author

N78-17174*# PPG Industries, Inc., Corpus Christi, Tex. Houston Chemical Company.
THE DETERMINATION OF ALUMINUM, COPPER, IRON, AND LEAD IN GLYCOL FORMULATIONS BY ATOMIC ABSORPTION SPECTROSCOPY
DOE Apr. 1977 17 p ref Prepared for DOE
(Contract NAS8-32255)
(NASA-CR-150520) Avail: NTIS HC A02/MF A01 CSCL 07D

Initial screening tests and the results obtained in developing procedures to determine Al, Cu, Fe, and Pb in glycol formulations are described. Atomic absorption completion was selected for Cu, Fe and Pb, and after comparison with emission spectroscopy, was selected for Al also. Before completion, carbon, iron, and lead are extracted with diethyl dithio carbamate (DDC) into methyl isobutyl ketone (MIBK). Aluminum was also extracted into MIBK using 8-hydroxyquinoline as a chelating agent. As little as 0.02 mg/l carbon and 0.06 mg/l lead or iron may be determined in glycol formulations. As little as 0.3 mg/l aluminum may be determined. Author

N78-17175*# National Aeronautics and Space Administration, Washington, D. C.
ON THE ACID DISULPHATE (PYROSULPHATE) OF NITROSYLE
Michel Wartel and Joseph Heubel Oct. 1977 6 p refs Transl. into ENGLISH of "Sur le Disulfate (Pyrosulfate) Acide de Nitrosyle" France, Comptes Rendus Hebdomadaires des Seances de L' Acad. des Sci., v. 261, 1965 p 5509-5511 Transl. by SCITRAN, Santa Barbara, Calif.
(Contract NASw-2791)
(NASA-TM-75170) Avail: NTIS HC A02/MF A01 CSCL 07D

Crystallized HS2O7NO was obtained by reacting excess NO2 gas with liquid HSO3Cl. Stable to a melting point of approximately 105 deg, this reacted with nitrates from about 25 deg and formed M2S2O7, with an acid disulphate intermediary. Excess NO2, whether liquid or gas, reacted with HS2O7NO to five (NO)2S2O7. Author

N78-17176*# Howard Univ., Washington, D. C.
LASER INDUCED PHOTOLUMINISCENCE STUDIES OF PRIMARY PHOTOCHEMICAL PRODUCTION PROCESSES OF COMETARY RADICALS Final Report
William M. Jackson [1977] 76 p refs
(Contract NsG-5071)
(NASA-CR-155924) Avail: NTIS HC A05/MF A01 CSCL 07D

A tunable vacuum ultraviolet flash lamp was constructed. This unique flash lamp was coupled with a tunable dye laser detector and permits the experimenter to measure the production rates of ground state radicals as a function of wavelength. A new technique for producing fluorescent radicals was discovered. This technique called multiphoton ultraviolet photodissociation is currently being applied to several problems of both cometary and stratospheric interest. It was demonstrated that NO2 will dissociate to produce an excited fragment and the radiation can possibly be used for remote detection of this species. Author

N78-17177# Illinois Univ., Urbana-Champaign. Dept. of Chemistry.
CHEMILUMINESCENCE OF DIPHENOYL PEROXIDE. CHEMICALLY INITIATED ELECTRON EXCHANGE LUMINESCENCE. A NEW GENERAL MECHANISM FOR CHEMICAL PRODUCTION OF ELECTRONICALLY EXCITED STATES
Ja-Young Koo and Gary B. Schuster 8 Dec. 1977 46 p refs
(Contract N00014-76-C-0745)
(AD-A047729; TR-10) Avail: NTIS HC A03/MF A01 CSCL 07/5

The thermal reactions of diphenoyl peroxide (1) were probed. It was found that when 1 was heated at 24 for 24 h in CH2C12 benzocoumarin (2) and a small amount of polymeric peroxide were formed. Under these conditions the reaction was essentially non-chemiluminescent. However, addition of any one of several easily oxidized fluorescent molecules resulted in readily detected chemiluminescence. The mechanism for chemical light formation was probed by investigating the: (1) effect of additives' structure, (2) reaction kinetics, (3) effect of solvent polarity and viscosity, (4) effect of reaction conditions on the products, (5) chemiluminescence emission, and (6) independent generation of proposed intermediates. These studies show that the chemiluminescence of 1 does not proceed by the one of the classical mechanisms. We propose a new general chemical light producing scheme identified as chemically initiated electron exchange luminescence. Author (GRA)

N78-17178# Aeronautical Research Associates of Princeton, Inc., N. J.
THE IGNITION, COMBUSTION, AND RADIANT INTENSITY OF SPHERICAL CLOUDS OF HYDROGEN Final Report
Priscilla C. Petersen, E. Stokes Fishburne, and Michael E. Neer Apr. 1977 38 p refs
(Contract F33657-76-C-0315)
(AD-A047979; ARAP-291) Avail: NTIS HC A03/MF A01 CSCL 13/2 .

The manner in which large hydrogen bubbles rise, mix, burn, and radiate is predicted for bubbles of varying diameter, initial velocity, and crosswind velocity using simplified models. The motion of buoyant gas bubbles in general is shown to be accurately

described by the simplified entrainment model of Shui and Weyl for a variety of bubble sizes and compositions including small hydrogen bubbles as reported in the Russian literature, large bubbles resulting from the combustion of stoichiometric methane-oxygen mixtures (GEST experiments), and very large thermals associated with nuclear explosions. The degree to which the mixing is incomplete on a molecular scale is inferred from the observed volume increase of small hydrogen bubbles immediately after ignition, using pseudo-equilibrium, calculations with a partial reaction feature. The accuracy of the model used to predict the time history of IR radiation from hot combustion gases is verified by comparison with the observed radiation from the combustion products of methane-oxygen bubbles.
Author (GRA)

N78-17179# Vermont Univ., Burlington. Dept. of Chemistry.
PHYSICAL AND CHEMICAL PROPERTIES OF SQUARATE COMPLEXES. 1: SPECTRAL, MAGNETIC, AND THERMAL BEHAVIOR OF DIMERIC IRON III SQUARATE
James T. Wrobleski and David B. Brown 8 Dec. 1977 18 p refs Submitted for publication
(Contract N00014-75-C-0756; NR Proj. 356-593)
(AD-A048223; TR-7) Avail: NTIS HC A02/MF A01 CSCL 07/2

The magnetic susceptibility behavior of an iron(III) squarate complex with empirical formula Fe(C404)(OH)(H2O3) has been studied in the range 20-300K. Presence of both terminally-coordinated bidentate squarate dianion and bridging hydroxy groups is supported by the infrared spectrum of the dimer. GRA

N78-17180# Michigan State Univ., East Lansing. Dept. of Chemistry.
SELECTED ION FRAGMENTATION WITH A TANDEM QUADRUPOLE MASS SPECTROMETER
R. A. Yost and C. G. Enke 14 Nov. 1977 8 p refs
(Contract N00014-76-C-1092)
(AD-A048011; TR-1) Avail: NTIS HC A02/MF A01 CSCL 14/2

A tandem quadrupole mass spectrometer is used to create ion species from a sample, separate one individual ion species, fragment it, and obtain the mass spectrum of the fragments. Practicability of the Selected Ion Fragmentation Tandem Quadrupole Mass Spectrometer (SIFT QMS) is experimentally demonstrated. Normally large ion losses due to scattering in the collision-induced dissociation (CID) process are eliminated by performing CID in a 'RF-only' quadrupole. CID spectra with unit mass resolution are produced by the quadrupole mass filters. The CID spectrum of each component of a cyclohexane mixture containing three minor components is presented. Potential applications of SIFT QMS in mixture analysis and structure elucidation are discussed. Author (GRA)

N78-17181# Institut Franco-Allemand de Recherches, St. Louis (France).
APPLICATION OF LDV TECHNIQUES TO HIGH SPEED COMBUSTION FLOWS
H. J. Schaefer, B. Koch, and H. J. Pfeifer 18 Apr. 1977 12 p refs Presented at the 7th Intern. Congr. on Instr. in Aerospace Simulation Facilities, Shrivenham, Engl., 6-8 Sep. 1977
(ISL-CO-204/77) Avail: NTIS HC A02/MF A01

The capability of laser Doppler velocimetry for measurements of high-speed reacting flows is demonstrated by presenting two examples for its applications on combustion chambers. The instrumentation used to overcome the particular difficulties in those applications is described. An estimation is given of possible errors due to fluctuating refractive index inhomogeneities in the flow. Author (ESA)

N78-17182# Georgia Inst. of Tech., Atlanta. School of Mechanical Engineering.
PREDICTION OF FIRE HAZARD FROM FABRICS AND BUILDING MATERIALS Research Report, Sep. 1975 - Feb. 1977
P. Durbetaki, W. C. Tincher, L. R. Lloyd, R. P. Lowry, and W. J. Tingle 28 Feb. 1977 267 p refs
(Grant NSF AEN-72-03359-A04)
(PB-273977/9; NBS-GCR-77-99; RR-5) Avail: NTIS HC A12/MF A01 CSCL 13L

Probabilistic failure analysis was proposed as a rational measure of a system's fire hazard and this was quantitatively expressed in terms of the probability with which use of a system leads to a prescribed loss. The fire loss probability was composed of all subprobabilities which are associated with the events and processes leading to the occurrence of the fire loss. Measurements were made to provide data on thermophysical properties, constitutive description of processes, and ignition times. Thermal radiative properties were measured both on original and charred samples of cellulosic and thermoplastic materials. GRA

N78-17107*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ELECTROPHORESIS TECHNOLOGY: EXPERIMENT MA-011
R. E. Allen, G. H. Barlow (Abbott Labs., Chicago), M. Bier (VA Hospital, Tucson, Ariz.), P. E. Bigazzi (State Univ. of N.Y., Buffalo), R. J. Knox (Univ. of Oreg. Health Sciences Center, Portland), F. J. Michale (Lehigh Univ., Bethlehem, Pa.), G. V. F. Seaman (Univ. of Oreg. Health Sciences Center, Portland), J. W. Vanderhoff (Lehigh Univ., Bethlehem, Pa.), C. J. VanOss (State Univ. of N.Y., Buffalo), W. J. Patterson et al *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 307-334 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 07D

N78-17108*# Max-Planck-Institut fuer Biochemie, Martinsried bei Muenchen (West Germany).
ELECTROPHORESIS: EXPERIMENT MA-014
K. Hannig, H. Wirth, and E. Schoen (Messerschmitt Boelkow Blohm GmbH, Munich) *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol., 1 1977 p 335-352 ref (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 07D

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N78-17183 Florida Univ., Gainesville.
A STUDY OF THE GLOBAL EVOLUTION OF MICROSTRUCTURES Ph.D. Thesis
Arun Mahadeo Gokhale 1977 223 p
Avail: Univ. Microfilms Order No. 77-25929

An approach was developed to evaluate the global geometrical properties of an evolving microstructure from a given description of the local variables. Effects of various growth geometries on the kinematics of phase transformations were explored in detail. A phenomenological approach is developed to evaluate the impingement equations for two and one dimensional growth geometries. This phenomenological approach is developed to evaluate the impingement equations for two and one dimensional growth geometries. This phenomenological approach is valid for both random and nonrandom impingements. A fairly general technique is developed to deduce the nucleation rate and growth rate from the time variation of the global properties. The practical feasibility of the approach is demonstrated by applying it to the experimental data on recrystallization and austenitization processes. The analysis is used to deduce the nucleation rate and growth rate of austenite, during the austenitization of a pearlitic structure. Dissert. Abstr.

N78-17184 Stanford Univ., Calif.
MECHANISMS OF GAS BUBBLE EMBRITTLEMENT OF METALS Ph.D. Thesis
Steven Howard Goods 1977 158 p
Avail: Univ. Microfilms Order No. 77-25672

The effect of a water vapor bubble microstructure on the creep-rupture behavior of polycrystalline silver was studied. By performing constant stress creep tests over the temperature range of 200 C to 550 C the stress and temperature dependence of the creep-rupture phenomenon was determined and it was found that the growth of the grain boundary bubbles is controlled by surface diffusion along the internal bubble surface.Dissert. Abstr.

N78-17185 Florida Univ., Gainesville.
MICROCHARACTERISTICS OF BINARY Fe-Ni ALLOYS INVESTIGATED BY TIME DEPENDENT ANGULAR CORRELATION TECHNIQUE Ph.D. Thesis
Edmondo Selvatici 1977 209 p
Avail: Univ. Microfilms Order No. 77-25953

Time dependent perturbed angular correlation (TDPAC) measurements were performed with a series of high purity binary Ni-Fe alloys to investigate the general applicability of the technique as a means of extracting information on the microcharacteristics of this alloy system. Trace amounts of the In-111 radioisotope were incorporated into alloy foils, having Ni-Fe compositions of Ni 90, Fe 10, Ni 60, Fe 40, and Ni 49, Fe 51, and rolled to approximately 0.1 mm thickness, and the time dependent angular correlation patterns, arising from the hyperfine interactions of the nuclear magnetic moments of the Cd-111 daughter nuclei with the crystalline magnetic hyperfine fields of the environment, were measured. The results reported have demonstrated the TDPAC technique to be a very powerful tool for investigating the microcharacteristics of materials. Dissert. Abstr.

N78-17186 Catholic Univ. of America, Washington, D. C.
OXIDATION OF IRON AT 100 DEG TO 300 DEG C Ph.D. Thesis
Timothy John Driscoll 1977 135 p
Avail: Univ. Microfilms Order No. 77-27981

Surface techniques were used to study the oxidation of iron at 100 to 300 C as a function of oxygen pressure and sulfur surface impurity content. The proton-excited-X-ray (PEX) technique was used to obtain the oxidation rate kinetics, and the PEX and Auger electron spectroscopy techniques were both used to characterize the preoxidation iron surface with respect to surface impurities. Results indicate that the oxidation of iron at 200 to 300 C is initially limited by adsorption, dissociation, or ionization of oxygen molecules on iron oxide surfaces. The oxide films which subsequently form at 100 and 200 C are relatively constant in thickness over the area of the iron samples; however, the iron oxide present at 300 C is in the form of oxide islands for exposures of up to the 9,600 Langmuirs used in these studies. Dissert. Abstr.

N78-17187*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MATERIALS TECHNOLOGY ASSESSMENT FOR STIRLING ENGINES
Joseph R. Stephens, Walter R. Witzke, Gordon K. Watson, James R. Johnston, and William J. Croft (Army Materials and Mechanics Res. Center, Watertown, Mass.) Oct. 1977 16 p refs Presented at Dept. of Energy Highway Vehicle Sys. Contractors' Coordination Meeting, Dearborn, Mich., 4-6 Oct. 1977
(Contract EC-77-A-31-1011)
(NASA-TM-73789; E-9356; CONS/1011-22) Avail: NTIS HC A02/MF A01 CSCL 11F

A materials technology assessment of high temperature components in the improved (metal) and advanced (ceramic) Stirling engines was undertaken to evaluate the current state-of-the-art of metals and ceramics, identify materials research and development required to support the development of automotive Stirling engines, and to recommend materials technology programs to assure material readiness concurrent with engine system development programs. The most critical component for each engine is identified and some of the material problem areas are discussed. Author

N78-17188*# Boeing Commercial Airplane Co., Seattle, Wash.
EFFECTS OF SERVICE ENVIRONMENTS ON ALUMINUM-BRAZED TITANIUM (ABTi)
W. L. Cotton Jan. 1978 41 p refs
(Contract NAS1-13681)
(NASA-CR-2943) Avail: NTIS HC A03/MF A01 CSCL 11F

Aluminum brazed titanium (ABTi) structures were evaluated during prolonged exposure to extreme environments: elevated temperature exposure to airline service fluids, hydraulic fluid, and seawater, followed by laboratory corrosion tests. Solid-face and perforated face honeycomb sandwich panel specimens, stressed panel assemblies, and faying surface brazed joints were tested. The corrosion resistance of ABTi is satisfactory for commercial airline service. Unprotected ABTi proved inherently resistant to attack by all of the extreme service aircraft environments except: seawater at 700 K (800 F) and above, dripping phosphate ester hydraulic fluid at 505 K (450 F), and a marine environment at ambient temperature. The natural oxides and deposits present on titanium surfaces in airline service provide protection against hot salt corrosion pitting. Coatings are required to protect titanium dripping phosphate ester fluid at elevated temperatures and to protect exposed acoustic honeycomb parts against corrosion in a marine environment. Author

N78-17189*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELEVATED-TEMPERATURE TENSILE AND CREEP PROPERTIES OF SEVERAL FERRITIC STAINLESS STEELS
J. Daniel Whittenberger Dec. 1977 22 p refs
(NASA-TM-73853; E-9440) Avail: NTIS HC A02/MF A01 CSCL 11F

The elevated-temperature mechanical properties of several ferritic stainless steels were determined. The alloys evaluated included Armco 18SR, GE 1541, and NASA-18T-A. Tensile and creep strength properties at 1073 and 1273 K and residual room temperature tensile properties after creep testing were measured. In addition, 1273 K tensile and creep tests and residual property testing were conducted with Armco 18SR and GE 1541 which were exposed for 200 hours to a severe oxidizing environment in automotive thermal reactors. Aside from the residual tensile properties for Armco 18SR, prior exposure did not affect the mechanical properties of either alloy. The 1273 K creep strength parallel to the sheet-rolling direction was similar for all three alloys. At 1073 K, NASA-18T-A had better creep strength than either Armco 18SR or GE 1541. NASA-18T-A possesses better residual properties after creep testing than either Armco 18SR or Ge 1541. Author

N78-17190*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELEVATED-TEMPERATURE FLOW STRENGTH, CREEP RESISTANCE AND DIFFUSION WELDING CHARACTERISTICS OF Ti-GAI-2Nb-1Ta-0.8Mo
J. Daniel Whittenberger and Thomas J. Moore Dec. 1977 31 p refs
(NASA-TM-73854; E-9441) Avail: NTIS HC A03/MF A01 CSCL 11F

A study of the flow strength, creep resistance and diffusion welding characteristics of the titanium alloy Ti-6Al-2Nb-1Ta-0. 8Mo was conducted. Two mill-processed forms of this alloy were examined. The forged material was essentially processed above the beta transus while the rolled form was subjected to considerable work below the beta transus. Between 1150 and 1250 K, the forged material was stronger and more creep resistant than the rolled alloy. Both forms exhibit superplastic characteristics in this temperature range. Strain measurements during diffusion welding experiments at 1200 K reveal that weld interfaces have no measurable effect on the overall creep deformation. Significant deformation appears to be necessary to produce a quality diffusion weld between superplastic materials. A 'soft' interlayer inserted between faying surfaces would seemingly allow manufacture of quality diffusion welds with little overall deformation. Author

N78-17191# Naval Ship Research and Development Center, Annapolis, Md. Materials Dept.
BURNER-RIG SIMULATION OF LOW-TEMPERATURE HOT CORROSION
Louis F. Aprigliano Nov. 1977 29 p refs
(AD-A047536; MAT-77-68) Avail: NTIS HC A03/MF A01 CSCL 13/10

Low velocity burner-rig tests were conducted at four temperatures: 1200 F (649 C), 1300 F (704 C), 1400 F (760 C), and 1550 F (844 C) in an attempt to simulate the low-temperature (circa 1300 F (704 C)) attack that is occuring on marine gas turbine hot section components. The tests were made by exposing CoCrAlY-coated Rene 80 test pins to a burner-rig environment burning marine diesel fuel containing 1 weight percent S at a 30 to 1 air-to-fuel ratio. The test environment contained 5 parts per million sea salt at 1200 F (649 C) and 10 parts per million at the other three temperatures. At 1200 F (649 C) and 1400 F (760 C) after 750 hours, there

was little or no hot-corrosion attack. At 1550 F (844 C) after 750 hours, typical high-temperature, hot-corrosion attack had occurred. At 1300 F (704 C) low-temperature, hot-corrosion attack was duplicated within 450 hours. The occurrence of low-temperature attack was found to be related to the presence of CoSO4. Author (GRA)

N78-17192# State Univ. of New York, Stony Brook. Dept. of Materials Sciences.

THE RESPONSE OF COATED STEELS TO CAVITATION IN CORROSIVE ENVIRONMENTS

H. Herman, C. Clayton, S. Agarwal, S. Safai, and J. Vargas May 1977 62 p refs

(Contract N00014-75-C-1018)

(AD-A047472; TR-2) Avail: NTIS MF A01 CSCL 11/6

Cavitation-erosion in marine environments can have serious, deleterious effects on coated steels. This work is aimed at a detailed understanding of these effects. Studies are being carried out on aluminum-zinc alloy and alumina-base ceramic coatings. The resistance to corrosive media of these coated steels are being studied, with and without polyurethane impregnation of the porous coating, since polymer-filled flame sprayed anodic coatings are known to give remarkable corrosion protection in a range of marine environments. Details of the thermal spray process are also being examined as these effect properties. Furthermore, transition metal/metalloid amorphous coatings are being examined. It is our intent to study erosive/corrosive effects where, for modern, high velocity marine vehicles, they are certain to play an important role. Author (GRA)

N78-17193# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Mechanical Engineering.

TWO CASES OF INCLUSION-INCLUSION INTERACTION IN A Ti ALLOY Final Report, 1 Apr. 1976 - 31 Aug. 1977

J. L. Swedlow and G. B. Sinclair Oct. 1977 76 p refs

(Grant AF-AFOSR-2993-76)

(AD-A047466; SM-77-7; AFOSR-77-1290TR) Avail: NTIS HC A05/MF A01 CSCL 11/6

A basic investigation was conducted to study the behavior of a continuous media with interacting inclusions. Material property data used for this study modeled an Alpha/Beta titanium. Finite element simulation of the media included a generalized von-Mises yield criteria for plasticity. Uniaxial loading was considered with the parametric variations of the angle between the line of the inclusions and the load direction. Further three boundary displacement restrain conditons were considered. From these analyses the strain localization of the inclusion interaction was examined. The Final Report contains the analyses output data and computer plots of the region experiencing plastic strain. This research is continuing under a separate grant to investigate the strain localization at the inclusions and the formation of microcracks. Author (GRA)

N78-17194# Naval Research Lab., Washington, D. C.

A METALLURGICAL CHARACTERIZATION AND ASSESSMENT OF SMA, GMA, EB, AND LB WELDS OF HY-130 STEEL Interim Report

J. Stoop and E. A. Metzbower 30 Sep. 1977 56 p refs

(AD-A047418; AD-E000042; NRL-8157) Avail: NTIS HC A04/MF A01 CSCL 13/5

HY-130 weldments of 6.35 and 12.7 mm thickness were fabricated by shielded metal arc (SMA), gas metal arc (GMA), electron beam (EB), and laser beam (LB) processes. Hardness explorations and metallographic examinations were made of the weld metal and heat-affected zone (HAZ) of the weldments. EB and LB weldments showed perceptibly higher weld metal hardnesses and steeper hardness gradients in the HAZ than corresponding SMA and GMA weldments. SMA and GMA welds consisted of a large percentage of acicular ferrite with smaller amounts of bainite and martensite; EB and LB welds comprised mostly martensite and a small percentage of bainite. Strain hardening exponent values for SMA, GMA, and LB welds were appreciably higher than the values obtained for EB welds and the base metal. As indicated by dynamic tear (DT) tests run at room temperature, the weld joint specimens exhibited mostly plane stress (slant) fracture. LB specimens disclosed a fracture toughness not only higher than that of the other weld joints but also comparable to the fracture toughness of the base metal. LB weld joint fracture energy values were found to be 94.5 to 97.7 percent of those of the base metal. Metallurgical conditions and variables that promote susceptibility to cold cracking were found to be more prevalent in SMA and GMA weldments than in EB and LB weldments. Inspection of the DT fractures disclosed a small to moderate amount of porosity in SMA and GMA weldments, the presence of cold shuts (incomplete fusion) in EB weldments, and some evidence on a minor scale of cold shuts and hydrogen embrittlement in the LB weldments. GRA

N78-17195# Naval Research Lab., Washington, D. C.

FATIGUE CRACK PROPAGATION RESISTANCE OF BETA-ANNEALED Ti-6Al-4V ALLOYS OF DIFFERING INTERSTITIAL OXYGEN CONTENTS Final Report

G. R. Yoder, L. A. Cooley, and T. W. Crooker 4 Oct. 1977 19 p refs

(AD-A047420; AD-E000029; NRL-8166) Avail: NTIS HC A02/MF A01 CSCL 11/6

Fatigue crack growth rates have been determined for beta-annealed Ti-6Al-4V alloys with respective oxygen contents of 0.06, 0.11, 0.18, and 0.20 weight percent. For each of these alloys, transitional crack growth behavior has been observed which appears to correlate with a critical value of the reversed plastic zone size: the Widmanstaetten packet size. Moreover, growth rates below transitional levels order in terms of packet size. The present results suggest that interstitial oxygen content and prior beta grain size significantly affect fatigue crack growth rates through control of the Widmanstaetten packet size.

Author (GRA)

N78-17196# Pittsburgh Univ., Pa. Dept. of Metallurgical and Materials Engineering.

EFFECT OF SOLUTE REDISTRIBUTION ON THE STRUCTURE AND PROPERTIES OF CAST ALLOYS: PERITECTIC SOLIDIFICATION AND MODEL OF CONTINUOUS CASTING

S. A. David, J. Mathew, and H. D. Brody Oct. 1977 54 p refs

(Contract N00014-75-C-0800)

(AD-A047485; SETEC-MME-77-110) Avail: NTIS HC A04/MF A01 CSCL 11/6

Two papers presented at the Sheffield International Symposium on Solidification are included. One paper covers a theory to describe the relation between casting conditions and structure in directionally solidified peritectic alloys. Experiments on Pb-Bi and Sn-Cd alloys are used to check the theory. The second paper describes the application of a computer model of continuous casting to study the effects of ingot diameter and casting rate on heat flow and thermal stresses in an aluminum-magnesium alloy. Author (GRA)

N78-17197# Naval Research Lab., Washington, D. C. Metals Performance Branch.

EFFECTS OF NATURAL SEAWATER AND ELECTROCHEMICAL POTENTIAL ON FATIGUE-CRACK GROWTH IN 5086 AND 5456 ALUMINUM ALLOYS Final Report

F. D. Bogar and T. W. Crooker 7 Oct. 1977 18 p refs

(RR0220146; RR0220844)

(AD-A047416; AD-E000045; NRL-8153) Avail: NTIS HC A02/MF 01 CSCL 11/6

Fatigue-crack growth in 5086-H116, 5086-H117, 5456-H116 and 5456-H117 aluminum alloys was measured in ambient air (R.H. approx. 50 percent) and in flowing natural seawater. Tests in seawater were conducted at the freely corroding (F.C.) potential (approx. -1.0 V) and at applied potentials of -0.75, -1.3, -1.4, and 1.5V. Results are presented in terms of cyclic crack-growth rate (da/dN) as a function of crack-tip stress-intensity range (delta K). Delta K values ranged from approximately 12 to 50 MPA(sq. root of m). In ambient air, all four alloys exhibited similar crack growth characteristics. Crack growth in the 5086 alloys was only slightly affected by either seawater or potential. However, crack growth in the 5456 alloys varied rather widely with seawater and potential. In particular, alloy 5456-H116 exhibited crack-growth rates which were significantly accelerated at the freely corroding potential, and both 5456 alloys exhibited crack-growth rates which were significantly retarded under cathodic potentials. Observations of electrochemically induced

crack arrest were made in both 5456 alloys under cathodic potential. Author (GRA)

N78-17198# Naval Research Lab., Washington, D. C.
ELEVATED TEMPERATURE PROPERTIES OF SHORT FIBER REINFORCED ALUMINUM Interim Report
W. L. Phillips and L. S. Weinman Sep. 1977 28 p refs
(AD-A047409; AD-E000032) Avail: NTIS HC A03/MF A01 CSCL 11/5

Recently two new reinforcing fibers have been developed. They are the very small SiC whiskers produced from rice hulls, an inexpensive by-product of the food processing industry, and graphite fiber mats produced directly from pitch without an intermediate yarn precursor. SiC/2024 Al and G/2024 Al composites with 21 volume percent reinforcement were manufactured by pressure casting ingots with random fiber orientations and then warm extruding the ingots to get a good degree of fiber alignment. For comparison purposes, an unreinforced 2024 Al control was subjected to the same thermomechanical treatment. Tensile properties were evaluated over a temperature range from room temperature to 380 C (720 F). The G/Al had poorer mechanical properties than unreinforced Al because there was excessive fiber breakage during extrusion. SiC/Al had a Young's elastic modulus and a specific elastic modulus which were both 50 percent greater than the values for wrought aluminum at temperatures up to 300 C (570 F). At temperatures less than 200 C (390 F), the SiC reinforced composite had 30 percent greater yield strength and fifteen percent greater tensile strength than the Al control. These SiC/Al data are encouraging because of the low projected cost of the whiskers, the economics associated with manufacturing composites by casting and extrusion, and the ease with which the composite can be cut using conventional steel tools. GRA

N78-17199# Naval Research Lab., Washington, D. C.
COOPERATIVE RADIATION EFFECTS SIMULATION PROGRAM Semiannual Progress Report, 1 Sep. 1976 - 28 Feb. 1977
L. E. Steele and L. A. Beach Sep. 1977 88 p refs
(AD-A047406; AD-E000037; NRL-MR-3588) Avail: NTIS HC A05/MF A01 CSCL 18/8

The Cooperative Radiation Effects Simulation Program (CORES) is a collaborative effort of the Engineering Materials and Radiation Technology Divisions of NRL materials and General Sciences Area. The goal of the research is to provide the theoretical and experimental bases for understanding the mechanisms of nuclear radiation damage of metals, as well as a theoretical insight into energy deposition processes. In this the Van de Graaff and Cyclotron are used to simulate rapidly the radiation damage produced over long periods in reactor neutron environments. Progress for this period includes: (1) the effect of focus on void and bubble size measurement by electron microscopy; (2) ultra-high-vacuum target furnace for heavy- ion irradiations; (3) a comparison of the swelling produced in nickel by neutron irradiation and by ion bombardment; (4) profiling light element concentrations by nuclear techniques; (5) transient ion-simulated irradiation-induced creep of nickel; and (6) displacement damage calculation procedures. GRA

N78-17200# Princeton Univ., N. J. Dept. of Chemistry.
IN SEARCH OF METAL-METAL METATHESIS IN THE CHEMISTRY OF COMPOUNDS CONTAINING METAL-TO-METAL TRIPLE BONDS BETWEEN MOLYBDENUM
M. H. Chisholm, F. A. Cotton, M. W. Extine, R. L. Kelly, and W. C. Mills 9 Dec. 1977 13 p refs
(Contract N00014-76-C-0826)
(AD-A047883; TR-77-06) Avail: NTIS HC A02/MF A01 CSCL 07/2

The occurrence of transition metal complexes containing metal-to-metal multiple bonds is now well documented. Scores of such compounds have been structurally characterized and several have been subjected to detailed spectroscopic examination. Recently X sub X-SW calculations have been carried out on compounds containing M-M bounds and the results have been correlated with the observed spectroscopic data. Despite the emergence of a basic understanding of the electronic structure of these compounds little is known about (1) the mechanisms of their formation and (2) the relationships that exist between the formation/existence of dinuclear compounds with M-M multiple bonds and cluster or polynuclear compounds of the same empirical formula. We have sought to gain insight into some of these mystiques by looking for the formation of heterodinuclear compounds containing M-M multiple bonds. We report here some findings relating to compounds containing triple bonds between molybdenum and tungsten atoms. Author (GRA)

N78-17111*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MONOTECTIC AND SYNTECTIC ALLOYS: EXPERIMENT MA-044
L. L. Lacy and C. Y. Ang *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 403-428 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 11F

N78-17116*# Academy of Sciences (USSR), Moscow.
MULTIPLE MATERIALS MELTING (METALS): PART OF EXPERIMENT MA-150
L. I. Ivanov, V. N. Kubasov, V. N. Pimenov, K. P. Gurov, E. V. Demina, U. S. Malkov, and V. M. Lazarenko *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 501-538 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 11F

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N78-17201 Stevens Inst. of Tech., Hoboken, N. J.
COMPUTER SIMULATION OF THE INJECTION MOLDING OF A LIQUID UNDERGOING LINEAR STEP POLYMERIZATION Ph.D. Thesis
Joseph Dominic Domine 1976 296 p
Avail: Univ. Microfilms Order No. 77-26932

A model was developed to simulate the one dimensional flow of a liquid undergoing step polymerization. Classical relationships for linear polymerization were employed to (1) relate the local extent of reaction (conversion) to the weight average molecular weight and, (2) to use the computed molecular weight to predict the local viscosity. The model simultaneously solves the balance equations for chemical species, momentum and energy. A methodology was developed to simulate the effect of the transverse flow at the moving interface. The results show that the process is parametrically sensitive to the feed condition reaction rate constant. Near the limiting values of reaction rate, which vary with pseudoplasticity index, the peak temperature varies sharply with small changes in reaction rate. Dissert. Abstr.

N78-17202 Minnesota Univ., Minneapolis.
THE CHARACTERIZATION AND RHEOLOGY OF POLYVINYL CHLORIDE PLASTISOLS Ph.D. Thesis
Stephen Jack Willey 1977 302 p
Avail: Univ. Microfilms Order No. 77-26178

The steady shear rheological properties of PVC plastisols were investigated at an intermediate volume fraction, phi = 0.20 and as concentrated suspensions at phi = 0.54. The effects of plastisol composition on suspension microstructure and rheological behavior were determined. Characteristics by particle size measurement in suspension, transmission electron microscopy, and differential scanning calorimetry determined that the emulsion resins were not swollen by plasticizer. Colloidal stability was interpreted in terms of steric stabilization theory. Partial dissolution of PVC species initially on the resin particle surface caused the plastisol continuous phase viscosity to increase with decreasing particle size at constant phi. Concentrated plastisols exhibited nonnewtonian viscosity, discontinuous dilatancy and a positive first normal stress difference. Dissert. Abstr.

N78-17203 Florida Univ., Gainesville.
CHEMICAL DURABILITY OF MULTICOMPONENT SILICATE GLASSES Ph.D. Thesis
Morris Franklin Dilmore 1977 276 p

Avail: Univ. Microfilms Order No. 77-25923
Well defined glass systems were used to illustrate all of the important parameters that effect corrosion. These included time, temperature composition, pH, SA/V, and soluble ion inhibitors. Simple two, three, and four component glass systems were used to study details of these effects of mixed alkali and alumina on glass corrosion reactions. Corrosion solution evaluation in conjunction with recently developed dissolution equations was employed as the standard evaluation technique. However, when required, more sophisticated surface analytical tools such as AES, IRRS, and SEM were used to compliment the corrosion solution results. Dissert. Abstr.

N78-17204 California Univ., Davis.
INVESTIGATIONS IN SILICATE GLASSES. 1: RADIATION DAMAGE. 2: OPTICAL NONLINEARITY Ph.D. Thesis
Michael James Moran 1977 268 p
Avail: Univ. Microfilms Order No. 77-27397
The investigation of two poorly understood but technologically important physical properties of silicate glasses and related materials is described. The use of electron paramagnetic resonance to investigate the nature of radiation-induced damage in glasses exposed to a variety of high energy radiation sources was examined. The measurement of the nonlinear index of refraction coefficient in a variety of optical materials related to the design of high power laser systems was studied. Dissert. Abstr.

N78-17205* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
POLYIMIDE ADHESIVES Patent
Donald J. Progar, Vernon L. Bell, and Terry L. StClair, inventors (to NASA) Issued 27 Dec. 1977 5 p Filed 22 Oct. 1976 Supersedes N77-15192 (15 - 06, p 0729) Continuation-in-part of abandoned US Patent Appl SN 532784, filed 16 Dec. 1974 (NASA-Case-LAR-12181-1; US-Patent-4,065,345; US-Patent-Appl-SN-734901; US-Patent-Class-156-309; US-Patent-Class-156-331; US-Patent-Class-260-30.4N; US-Patent-Class-260-32.2R; US-Patent-Class-260-32.6NT; US-Patent-Class-260-33.4R; US Patent-Appl-SN-532784) Avail: US Patent Office CSCL 11A
A process was developed for preparing aromatic polyamide acids for use as adhesives by reacting an aromatic dianhydride to an approximately equimolar amount of an aromatic diamine in a water or lower alkanol miscible ether solvent. The polyamide acids are converted to polyimides by heating to the temperature range of 200 - 300 C. The polyimides are thermally stable and insoluble in ethers and other organic solvents.
Official Gazette of the U.S. Patent Office

N78-17206* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THERMAL SHOCK AND EROSION RESISTANT TANTALUM CARBIDE CERAMIC MATERIAL Patent
Leroy Honeycutt, III (N.C. State Univ., Raleigh) and Charles R. Manning, inventors (to NASA) (N.C. State Univ., Raleigh) Issued 10 Jan. 1978 4 p Filed 1 Apr. 1976 Supersedes N76-23436 (14 - 14, p 1783) Sponsored by NASA (NASA-Case-LAR-11902-1; US-Patent-4,067,742; US-Patent-Appl-SN-672695; US-Patent-Class-106-43; US-Patent-Class-60-200A; US-Patent-Class-75-229; US-Patent-Class-75-239; US-Patent-Class-75-241) Avail: US Patent Office CSCL 11B
Ceramic tantalum carbide artifacts with high thermal shock and mechanical erosion resistance are provided by incorporating tungsten-rhenium and carbon particles in a tantalum carbide matrix. The mix is sintered by hot pressing to form the ceramic article which has a high fracture strength relative to its elastic modulus and thus has an improved thermal shock and mechanical erosion resistance. The tantalum carbide is preferable less than minus 100 mesh, the carbon particles are preferable less than minus 100 mesh, and the tungsten-rhenium particles are preferable elongate, having a length to thickness ratio of at least 2/1. Tungsten-rhenium wire pieces are suitable as well as graphite particles. Official Gazette of U.S. Patent Office

N78-17207 Florida Univ., Gainesville.
STUDY OF CYCLOCOPOLYMERIZATION Ph.D. Thesis
Yuan Chieh Chu 1977 141 p
Avail: Univ. Microfilms Order No. 77-29233
The structure of the alternating 1:2 cyclocopolymer of divinyl ether and maleic anhydride were reexamined by use of spectroscopic methods. A linear, soluble copolymer was obtained by the copolymerization in solvents with active hydrogens, such as chloroform and xylene. Their spectra showed the existence of both monomers in the copolymer based on the strong bands at 1775, 1855, 1230 cm to the -1 power (cyclic anhydride), and 1090 cm to the -1 power (cyclic ether). The participation of the charge transfer complex in the cyclocopolymerization was investigated with the divinyl ether-fumaronitrile system by light initiation. The evidence and the composition of the complex were obtained by the UV spectroscopic method. The structure of the copolymer was proposed on the basis of elemental analysis and C-13 nmr spectrum, as a mixture of 1:1 cyclocopolymer and 1:2 cyclocopolymer structures, both with six-membered rings.
Dissert. Abstr.

N78-17208 North Carolina State Univ., Raleigh.
ELONGATIONAL RHEOLOGY OF POLY(ETHYLENE TEREPHTHALATE) Ph.D. Thesis
Jackie Wayne Hill 1977 189 p
Avail: Univ. Microfilms Order No. 77-29625
The elongational flow behavior of polyethylene terephthalate during fiber spinning was investigated under both nonisothermal and isothermal spinning conditions. In the first study, four different molecular weight polymers were melt spun using conventional nonisothermal conditions with cooling of the threadline by free convection. Linear density samples taken along the threadline were used to obtain the elongation viscosity along the threadline. Threadline surface temperature measurements were made to relate the elongational viscosity and temperature. The elongational viscosity was found to increase as the molecular weight of the polymer increased. Approximations of the activation energy of elongational flow indicated that the activation energy was decreasing linear function of the elongation rate. Dissert. Abstr.

N78-17209 Carnegie-Mellon Univ., Pittsburgh, Pa.
INTERMOLECULAR INTERACTIONS IN MODERATELY CONCENTRATED POLYMER SOLUTIONS: A STUDY OF POLYSTYRENE IN SEVERAL SOLVENTS BY VISCOMETRY AND LIGHT SCATTERING Ph.D. Thesis
Bruce Leslie Hager 1977 235 p
Avail: Univ. Microfilms Order No. 77-28820
Solutions of narrow distribution, linear polystyrene 3.43< or equal to 0.0001(M sub w)< or equal to 211 in cyclohexane, cyclopentane, 2-butanone, and benzene, were examined by light scattering and viscosity measurements in the moderately concentrated regime. For concentrations great enough to allow reasonable coil overlap, the viscosity was correlated by the product of a structure factor and a friction factor. At low concentrations, the friction factor was found to be proportional to the solvent viscosity. At greater concentrations, accounting for the friction factor was accomplished empirically as a first-order deviation in concentration. The structure factor employed was essentially that of Bueche in terms of the parameter X=(< S squared >) sub o/M (Z/v sub 2) phi sub 2, with the modification that the concentration dependent mean square radius of gyration (< S squared >) sub 0 replaced its unperturbed value (< S squared >) sub 0. Dissert. Abstr.

N78-17210 Utah Univ., Salt Lake City.
THE EFFECT OF PRESSURE ON THE DIELECTRIC RELAXATION OF LINEAR POLYETHYLENE Ph.D. Thesis
John Alan Sayre 1977 145 p
Avail: Univ. Microfilms Order No. 77-28102
The alpha and gamma relaxation processes were studied using precision bridge techniques from 10 Hz to 10 kHz. The alpha process could be studied over a much wider temperature range due to the effect of pressure in increasing the melting point. Examination of relaxation strength from 50 C to 150 C showed that there must be two crystalline relaxation processes; the well known alpha relaxation plus a competing one. The effect of pressure on the activation parameters and shape of the gamma process was determined. Whether the gamma process occurs only in the amorphous fraction or in both the amorphous and crystalline phases was discussed. Increasing the pressure should change the slope of the loss curves if the process occurs in

both phases. The shape of the loss curves was found to be remarkably independent of pressure. This finding strengthens the view that the gamma process is entirely amorphous in origin.
Dissert. Abstr.

N78-17211 Texas Univ., Austin.
SORPTION AND TRANSPORT OF GASES IN GLASSY POLYMERS Ph.D. Thesis
William John Koros 1977 274 p
Avail: Univ. Microfilms Order No. 77-29056

A theoretical and experimental study of gas sorption and transport in glassy polymers is presented. The differences between these processes in the glassy and rubbery states were discussed and related to the nonequilibrium nature of glasses. The nonequilibrium character of glasses was believed to give rise to dual modes of sorption and transport in these materials. The sorption isotherms of gases in glassy polycarbonate and polyethylene terephthalate were described by a superposition of the normal Henry's law term associated with rubbers and an additional Langmuir term characteristic of glasses. Diffusion of gases in these glassy polymers was described by attributing separate mobilities to each of the two sorbed species mentioned above. Dissert. Abstr.

N78-17212 Carnegie-Mellon Univ., Pittsburgh, Pa.
SELECTIVE SEPARATIONS OF COPPER AND NICKEL USING LIQUID SURFACTANT MEMBRANES AND POROUS POLYMER FILMS Ph.D. Thesis
Kyung Hee Lee 1977 126 p
Avail: Univ. Microfilms Order No. 77-19192

A liquid surfactant membrane and a porous polymer film supported liquid membrane were constructed and investigated. A theory for predicting the copper or copper and nickel fluxes as a function of carrier concentration in the membrane and metal ion concentration and pH on both sides of the membrane was developed and tested. An extension of the coupled facilitated diffusion model was developed to include simultaneous transport of copper and nickel ions. The behavior of supported liquid membrane showed a good quantitative agreement with the theory, but that of liquid surfactant membranes did not. The lack of quantitative agreement in the latter case is probably the results of changes in effective membrane surface area and thickness as pH, carrier concentration, metal ions, etc., are varied.
Dissert. Abstr.

N78-17213* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
FLAME RETARDANT SPANDEX TYPE POLYURETHANES Patent
John T. Howarth (Little, Arthur D., Cambridge, Mass.), Suresh Sheth (Little, Arthur D., Cambridge, Mass.), Kenneth R. Sidman (Little, Arthur D., Cambridge, Mass.), and Arthur A. Massucco, inventors (to NASA) (Little, Arthur D., Cambridge, Mass.) Issued 17 Jan. 1978 10 p Filed 13 Feb. 1976 Supersedes N76-24408 (14 - 15, p 1912) Division of US Patent Appl. SN-374421, Filed 28 Jun. 1973, US-Patent-3,956,233 Sponsored by NASA
(NASA-Case-MSC-14331-2; US-Patent-4,069,212;
US-Patent-Appl-SN-657907; US-Patent-Class-260-77.55P;
US-Patent-Class-260-75NH; US-Patent-Class-260-75NK;
US-Patent-Class-260-75NT; US-Patent-Class-260-77.5AM;
US-Patent-Class-260-77.5AN; US-Patent-Class-260-77.5AP;
US-Patent-Class-260-77.5AT; US-Patent-3,956,233;
US-Patent-Appl-SN-374421) Avail: US Patent Office CSCL 11E

Flame retardant elastomeric compositions were developed, comprised of: (1) spandex type polyurethane having incorporated into the polymer chain, halogen containing polyols; (2) conventional spandex type polyurethanes in physical admixture flame retardant additives; and (3) fluoroelastomeric resins in physical admixture with flame retardant additives. Methods of preparing fibers of the flame retardant elastomeric materials are presented and articles of manufacture comprised of the elastomeric materials are mentioned. Official Gazette of the U.S. Patent Office

N78-17214* National Aeronautics and Space Administration. Pasadena Office, Calif.
NUCLEAR ALKYLATED PYRIDINE ALDEHYDE POLYMERS AND CONDUCTIVE COMPOSITIONS THEREOF Patent
Alan Rembaum (JPL) and Stanley Singer, inventors (to NASA) Issued 3 Nov. 1970 3 p Filed 11 Sep. 1968 Sponsored by NASA
(NASA-Case-NPO-10557; US-Patent-3,538,053;
US-Patent-Appl-SN-759220; US-Patent-Class-260-67) Avail: US Patent Office CSCL 07C

A thermally stable, relatively conductive polymer was disclosed. The polymer was synthesized by condensing in the presence of catalyst a 2, 4, or 6 nuclear alklylated 2, 3, or 4 pyridine aldehyde or quaternary derivatives thereof to form a polymer. The pyridine groups were liked by olefinic groups between 2-4, 2-6, 2-3, 3-4, 3-6 or 4-6 positions. Conductive compositions were prepared by dissolving the quaternary polymer and an organic charge transfer complexing agent such as TCNQ in a mutual solvent such as methanol.
Official Gazette of the U. S. Patent Office

N78-17215* National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD OF ADHERING BONE TO A RIGID SUBSTRATE USING A GRAPHITE FIBER REINFORCED BONE CEMENT Patent
Albert C. Knoell (JPL) and Hugh G. Maxwell, inventors (to NASA) (JPL) Issued 27 Dec. 1977 5 p Filed 6 Apr. 1976 Supersedes N76-26281 (14 - 17, p 2166) Sponsored by NASA
(NASA-Case-NPO-13764-1; US-Patent-4,064,566;
US-Patent-Appl-SN-674194; US-Patent-Class-3-1.9;
US-Patent-Class-128-92C; US-Patent-Class-128-92G;
US-Patent-Class-260-42.17) Avail: US Patent Office CSCL 11A

A method is described for adhering bone to the surface of a rigid substrate such as a metal or resin prosthesis using an improved surgical bone cement. The bone cement has mechanical properties more nearly matched to those of animal bone and thermal curing characteristics which result in less traumatization of body tissues and comprises a dispersion of short high modulus graphite fibers within a bonder composition including polymer dissolved in reactive monomer such as polymethylmethacrylate dissolved in methylmethacrylate monomer.
Official Gazette of the U.S. Patent Office

N78-17216*# United Technologies Research Center, East Hartford, Conn.
DEVELOPMENT OF Si3N4 AND SiC OF IMPROVED TOUGHNESS Final Report
John J. Brennan and Charles O. Hulse 25 Oct. 1977 148 p refs
(Contract NAS3-19731)
(NASA-CR-135306; R77-912252-23) Avail: NTIS HC A07/MF A01 CSCL 11B

The application of energy absorbing surface layers to Si3N4 and SiC was investigated. Among the layers studied were microcracked materials such as iron titanate and a silica-zircon mixture and porous materials such as reaction sintered Si3N4. Energy absorption due to microcrack extension upon impact was found not to be an important mechanism. Instead, the fivefold improvement in Charpy and ballistic impact at elevated temperature (1250 C and 1370 C) found for Fe2TiO5 was due to plastic deformation while similar improvement found for silica-zircon mixtures at RT was due to crushing of the porous material. Due to thermal expansion mismatch, these two materials could not withstand thermal cycling when used as energy absorbing surface layers on Si3N4. Reaction sintered Si3N4 layers on dense Si3N4 were found to give up to a sevenfold increase in ballistic impact resistance due to crushing of the layer upon impact. High porosity (45%), large particle size R.S. Si3N4 layers fabricated from -100, +200 mesh Si powder gave better impact improvement than less porous (30%), small particle size layers fabricated from -325 mesh Si powder. Author

N78-17217*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ALKALI-METAL SILICATE BINDERS AND METHODS OF MANUFACTURE Patent Application
John B. Schutt, inventor (to NASA) Filed 21 Dec. 1977 15 p
(NASA-Case-GSC-12303-1; US-Patent-Appl-SN-862880) Avail: NTIS HC A02/MF A01 CSCL 11A

Binders were made from alkali metal silicates exhibiting a high silicon dioxide mol ratio which is important in establishing a characteristic of high resistance to water solubility. The binders are stable during manufacture and storage and may be made with inexpensive components. The process of making these binders is predictable and repeatable. The process involves mixing a starter alkali metal metal silicate solution with silicon dioxide hydrogel and then with water and silicone. The final product binder contains silicon dioxide and an alkali metal oxide, water and silicone. The silicone dioxide is in the form of a hydrogel sol. The hydrogel sol allows for the high mol ratio (for insolubility) and a high inorganic solids content for low porosity. NASA

N78-17218*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

MIXED DIAMINES FOR LOWER MELTING ADDITION POLYIMIDE PREPARATION AND UTILIZATION Patent Application

Terry L. StClair, inventor (to NASA) Filed 6 Oct. 1977 13 p (NASA-Case-LAR-12054-1; US-Patent-Appl-SN-839963) Avail: NTIS HC A02/MF A01 CSCL 07C

By employing a mixture of methylene dianilines as the diamine portion of the oligomer in an addition polymerization process, an oligomer is produced that is tacky and nonboardy when used to form a prepreg. This mixed diamine oligomer melts in the 175-200 C temperature range during processing and requires only approximately 200 psi molding pressure to fabricate composite structures having equal or better physical property characteristics than those produced previously at 1000 psi molding pressure. Composites prepared from oligomers of this type can be thermoformed at elevated temperatures after an initial molding in the 175-200 C temperature range due to this lowered melting temperature of the mixed diamines. NASA

N78-17219*# IIT Research Inst., Chicago, Ill.

SPACE RADIATION RESISTANT TRANSPARENT POLYMERIC MATERIALS Final Report, 22 Aug. 1975 - 21 Jun. 1976

C. Giori and T. Yamauchi Dec. 1977 151 p refs (Contract NAS1-14133)

(NASA-CR-2930; C6359-11) Avail: NTIS HC A08/MF A01 CSCL 11G

A literature search in the field of ultraviolet and charged particle irradiation of polymers was utilized in an experimental program aimed at the development of radiation stable materials for space applications. The rationale utilized for material selection and the synthesis, characterization and testing performed on several selected materials is described. Among the materials tested for ultraviolet stability in vacuum were: polyethyleneoxide, polyvinylnaphthalene, and the amino resin synthesized by the condensation of o-hydroxybenzoguanamine with formaldehyde. Particularly interesting was the radiation behavior of poly (ethyleneoxide), irradiation did not cause degradation of optical properties but rather an improvement in transparency as indicated by a decrease in solar absorptance with increasing exposure time. Author

N78-17220*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECTS OF HYDROTHERMAL EXPOSURE ON A LOW-TEMPERATURE CURED EPOXY

Richard W. Lauver 1978 12 p refs Presented at the 33rd Ann. Conf. of Reinforced Plastics/Composites Inst. of the Soc. of the Plastics Ind., Inc., Wash., D. C., 7-10 Feb. 1978

(NASA-TM-73841; E-9428) Avail: NTIS HC A02/MF A01 CSCL 11C

Thermal mechanical analysis was employed to monitor the penetration temperature of a low-temperature epoxy resin. Both neat resin and E-glass composite samples were examined. The effects of cure temperature variation and moisture content on the apparent glass transition temperature were determined. Author

N78-17221*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PMR POLYIMIDE PREPREG WITH IMPROVED TACK CHARACTERISTICS

Tito T. Serafini and Peter Delvigs 1976 13 p refs Proposed for presentation at 2d Intern. Conf. on Composite Materials, Toronto, Can., 16-21 Apr. 1978; sponsored by Am. Inst. of Mining, Metallurgical and Petroleum Engineers

(NASA-TM-73898) Avail: NTIS HC A02/MF A01 CSCL 11C

Current PMR Polyimide prepreg technology utilizes methanol or ethanol solvents for preparation of the PMR prepreg solutions. The volatility of these solvents limits the tack and drape retention characteristics of unprotected prepreg exposed to ambient conditions. Studies conducted to achieve PMR 15 Polyimide prepreg with improved tack and drape characteristics were described. Improved tack and drape retention were obtained by incorporation of an additional monomer. The effects of various levels of the added monomer on the thermo-oxidative stability and mechanical properties of graphite fiber reinforced PMR 15 composites exposed and tested at 316 C (600 F) were discussed. Author

N78-17222# Royal Aircraft Establishment, Farnborough (England).

THE CALCULATION OF GLASS TRANSITION TEMPERATURES OF IONIC POLYMERS

R. Becker May 1977 18 p refs Transl. into ENGLISH from Z. Phys. Chemie (Leipzig), v. 257, no. 4, 1976 p 667-677

(RAE-Lib-Trans-1922; BR60223) Avail: NTIS HC A02/MF A01

A generally applicable approximation equation for the calculation of the glass transition temperature of ionic homo- and co-polymers is presented and discussed based on experimental values and familiar approximation equations. The equation had the form: T sub g = (Y + Sigma z sub i q sub i squared (K prime w sub i/d sub i))/Z where Y was the molar glass transition temperature coefficient, Z was the sum of interatomic distances of the base polymer, z sub i was the number of counter-ions, i for each Z, q sub i was the charge on these ions, d sub i was the distance of interionic bonds, w sub i was a weighting factor and K prime was a constant with the numerical value 4150. Author

N78-17223*# Washington Univ., Seattle. Coll. of Engineering.

INTERDISCIPLINARY RESEARCH AND DEVELOPMENT ON THE EFFECTS OF THE NATURE AND PROPERTIES OF CERAMIC MATERIALS IN THE DESIGN OF ADVANCED STRUCTURAL COMPONENTS Semiannual Status Report

16 Jan. 1978 36 p refs

(Grant NGR-48-002-004)

(NASA-CR-155733; SASR-29) Avail: NTIS HC A03/MF A01 CSCL 11B

An educational development and supportive research program on ceramic materials established to advance design methodology, improve materials, and develop engineers knowledgeable in design with and use of high performance ceramic materials is described. Emphasis is on the structures and related materials problems in a ceramic turbine engine, but applications in coal gasification, solar conversion, and magnetohydrodynamic technologies are considered. Progress of various research projects in the areas of new materials, processing, characterization, and nondestructive testing is reported. Fracture toughness determination, extended X-ray absorption fine structure measurements, and grain boundary effects in beta-alumina are among the topics covered. J.M.S.

N78-17224# Ocean City Research Corp., N.J.

EVALUATION OF CORROSION INHIBITOR ADDITIVES FOR ALKALINE FLIGHT DECK CLEANING SOLUTIONS Final Report

George A. Gehring, Jr. and Doreen L. Behmke 23 Nov. 1977 24 p refs

(Contract N68335-76-C-4458)

(AD-A047486; NAEC-ENG-7930) Avail: NTIS HC A02/MF A01 CSCL 11/11

The flight deck cleaning detergent specified by NAVSHIPS Bulletin is a highly alkaline, 3% sodium metasilicate solution. It was found to accelerate corrosion of the aluminum track covers on the USS Roosevelt. Laboratory tests showed that sodium naphthenate at a proper concentration inhibits corrosion of aluminum in alkaline solutions. However, sodium naphthenate degrades the cleansing ability of the metasilicate/detergent solution on certain soiling mediums. Thus, it does not appear

feasible to use sodium naphthenate as an additive in deck cleaning solutions. Author (GRA)

N78-17225# Washington State Univ., Pullman. Dept. of Materials Science and Engineering.
ELECTROINITIATED POLYMERIZATION THROUGH ACETYLENE AND NITRILE GROUP BONDS
R. V. Subramanian, J. Jakubowski, and B. K. Garg Nov. 1977 12 p refs
(Contract N00014-75-C-0792)
(AD-A047492; TR-3) Avail: NTIS HC A02/MF A01 CSCL 07/3

The polymerization of monomers through acetylenic and nitrile groups was studied. In the cathodic polymerization of phenylacetylene in dimethylformamide, an anionic polymerization mechanism is indicated. The polymer of molecular weight approximately 3000 was fractionated and the fractions characterized by IR, UV, and NMR spectroscopy. Evidence is presented for a conjugated polyene structure formed from cis and trans structural units combined in a predominantly head-to-tail fashion. Similarly, the polymerization of benzonitrile in dimethylformamide at the cathode leads to a polymer with conjugated -C=N- bonds. Mass spectroscopy did not reveal the presence of any cyclis trimer of benzonitrile. Infrared absorption bands at 1/1605 cm and 1/1520 cm established the formation of -C=N- conjugation in polybenzonitrile. GRA

N78-17226# General Electric Co., Schenectady, N. Y. Corporate Research and Development.
INVESTIGATION OF CERAMICS FOR HIGH TEMPERATURE TURBINE COMPONENTS Final Report, 25 Mar. 1976 - 25 Mar. 1977
Curtis A. Johnson and Svante Prochazka Jun. 1977 131 p refs
(Contract N62269-76-C-0243)
(AD-A047504; SRD-77-145; NADC-75228-30) Avail: NTIS HC A07/MF A01 CSCL 11/2

The mechanical properties of boron-doped sintered SiC were studied as a function of several fabrication and testing variables. The reduction in severity of surface defects due to the dissociation of SiC at high temperatures was characterized as a function of furnace pressure during sintering and as a function of refiring temperature after machining. The beta to alpha polytype transformation and the accompanying grain growth were found to decrease the strength a maximum of approximately 25 percent. Oxidation for times to 2000 hours at 1500 C in air resulted in no net loss of strength. The time-temperature-strength interdependence was studied at temperatures from 1200 to 2100 C and times to failure from one second to five hours. The creep behavior was also studied in the vicinity of 2100 C. A method was demonstrated to derive statistical quantities such as the Weibull modulus from the positions of fracture origins, and two examples of fracture data were discussed which illustrate the effects of bimodal flaw distributions. Hot pressing experiments suggest that the large cavities often observed in sintered microstructures are caused by bridging of agglomerates during powder compaction. Preliminary studies of increasing K sub 1C through the addition of second phase particles has not been successful.Author (GRA)

N78-17227# North Carolina Univ., Raleigh. Dept. of Materials Engineering.
MICROSTRUCTURE, ELECTRONIC PROPERTIES AND CHEMICAL DURABILITY OF VANADIUM-PENTOXIDE-BASED GLASSES AND GLASS-CERAMICS Final Report, 1 Nov. 1974 - 30 Apr. 1977
Abdel A. Fahmy 1 Jun. 1977 43 p refs
(Grant DAHC04-75-G-0071)
(AD-A047939; ARO-12954.1-MS) Avail: NTIS HC A03/MF A01 CSCL 11/2

Crystallization of Vanadium Pentoxide from Vanadium Pentoxide-Phosphorous Pentoxide glasses containing 0-9 mol% Boron Trioxide during heat treatment in the range 220 C-410 C caused progressive microstructural changes which dramatically affected the electronic conductivity, the activation energy for conduction, and the resistance to chemical attack. All compositions were approximately 83% crystalline after heating to 410 C. As a result, the values of conductivity and activation energy were almost identical to those observed for pure polycrystalline Vanadium-Pentoxide. Author (GRA)

N78-17228# European Space Agency, Paris (France).
THE INFLUENCE OF NITRIDING CONDITIONS ON MICROSTRUCTURE AND MECHANICAL PROPERTIES OF REACTION BONDED SILICON NITRIDE
Juergen Heinrich and Manfred Boehmer Dec. 1977 31 p refs
Transl. into ENGLISH of 'Der Einfluss von Nitridierbedingungen auf das Gefuege u. die mech. Eigenschaften von reaktionsgesintertem Siliziumnitrid', DFVLR, Cologne Report DLR-FB-77-22, 27 May 1977 Original report in GERMAN previously announced as N78-14102 Original GERMAN report available from DFVLR, Cologne DM 16.20
(ESA-TT-439; DLR-FB-77-22) Avail: NTIS HC A03/MF A01

The dependence of microstructure and the resulting mechanical properties of reaction bonded silicon nitride on density, composition, and pressure of nitriding gas, as well as alpha/beta ratio, was determined. These processing parameters strongly influence microstructure. Flexural strength is primarily determined by the total porosity and, in case of identical total porosity, by the pore size. Author (ESA)

N78-17115*# California Univ., Los Angeles.
HALIDE EUTECTIC GROWTH: EXPERIMENT MA-131
A. S. Yue, C. W. Yeh, and B. K. Yue *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 491-500 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 07D

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power*, *20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

N78-17229*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ALTERNATIVE AIRCRAFT FUELS
J. P. Longwell (MIT, Cambridge) and J. Grobman Jun. 1977 22 p refs Proposed for presentation at 23d Ann. Intern. Gas Turbine Conf., London, Engl., 9-13 Apr. 1978; sponsored by Am. Soc. of Mechan. Engineers
(NASA-TM-73836) Avail: NTIS HC A02/MF A01 CSCL 21D

The efficient utilization of fossil fuels by future jet aircraft may necessitate the broadening of current aviation turbine fuel specifications. The most significant changes in specifications would be an increased aromatics content and a higher final boiling point in order to minimize refinery energy consumption and costs. These changes would increase the freezing point and might lower the thermal stability of the fuel, and could cause increased pollutant emissions, increased combustor liner temperatures, and poorer ignition characteristics. The effects that broadened specification fuels may have on present-day jet aircraft and engine components and the technology required to use fuels with broadened specifications are discussed. Author

N78-17230*# National Aeronautics and Space Administration. Pasadena Office, Calif.
HIGH PERFORMANCE AMMONIUM NITRATE PROPELLANT Patent Application
Floyd A. Anderson, inventor (to NASA) (JPL) Filed 16 Dec. 1977 26 p
(Contract NAS7-100)
(NASA-Case-NPO-14260; US-Patent-Appl-SN-861390) Avail: NTIS HC A03/MF A01 CSCL 21I

Propellants having the combustion efficiency and high burning rates normally only achieved with perchlorates, have now been formulated with ammonium nitrate as the primary oxidizer, and with powdered metal fuel, all of which permits the use of lesser amounts of perchlorate oxidizer. These novel formulations greatly reduce the total hydrogen chloride emissions to the atmosphere, and hence are particularly desirable for the Space Shuttle propulsion systems. NASA

N78-17231# Thiokol Corp., Huntsville, Ala.
STATISTICAL ANALYSIS OF STEADY STATE COMBUSTION OF NONMETALLIZED COMPOSITE SOLID PROPERTIES Interim Report, 1 Jul. 1976 - 30 Sep. 1977
R. L. Glick Sep. 1977 57 p refs
(Contract F49620-76-C-0008)
(AD-A047491; U-77-08; AFOSR-77-1277TR) Avail: NTIS HC A04/MF A01 CSCL 21/8

The combustion model including aluminum and iron oxide was employed to correlate data bases of Miller and Maykut. Results for additive free formulations were excellent for both rate and exponent; results for formulations with aluminum and aluminum plus iron oxide were poor. A new method for extracting particle size dependent information from rate/response function/formulation data was developed from the statistical methodology itself and employed to process the aforementioned data bases. Results were encouraging; Miller's additive free and aluminum plus iron oxide data correlated very well; Miller's aluminum data showed that the increasing aluminum particle size increases interactions between oxidizer modes; Maykut's data base showed that aluminum induced interactions among oxidizer modes are decreased as iron content increases. Results elucidate mechanisms for rate, exponent, and response function control and show that the equal rate hypothesis employed in much combustion modeling is incorrect. A new approach for including the effects of transients introduced by particle size dependent rates in both steady and nonsteady combustion modeling was conceived.
Author (GRA)

N78-17232# Southwest Research Inst., San Antonio, Tex.
THE EFFECTS OF SHIELDED TOTE BINS ON THE SAFE SEPARATION OF 168 POUNDS OF COMPOSITION A-7 EXPLOSIVE Final Report
A. B. Wenzel and R. M. Rindner Sep. 1977 67 p refs
(Contract DAAA21-75-C-0324)
(AD-A047380; AD-E400007; SWRi-02-4343; ARLCD-CR-77012) Avail: NTIS HC A04/MF A01 CSCL 19/1

This program was carried out to determine the minimum safe separation distance between stainless steel tote bins protected with Kevlar shielding. Each tote bin contained 168 pounds of Composition A-7 traveling on a simulated conveyor system within a tunnel or ramp. Full-scale tests were conducted to determine: (1) the effectiveness of the Kevlar shield, (2) the minimum safe separation distance in a steel-fiberglass tunnel configuration, (3) the source of detonation and-or propagation, either primary (tote bin) or secondary (conveyor) fragments, or both, (4) the safe separation distance in a wooden-fiberglass tunnel, and (5) the effects of confinement on detonation and-or propagation of acceptors. The results of this study are briefly summarized as follows: (1) the thickness of Kevlar tested was ineffective in preventing ignition at 130 feet in a steel tunnel configuration. Even though propagation (detonation) did not occur, a fire broke out at this distance. (2) Primary fragments (tote bin) were the most likely source of detonation and-or propagation. (3) No propagation was observed at 130 feet when a wooden-fiberglass structure was used. (4) Blast-focusing due to the presence of the tunnel walls can affect the trajectory of the fragments as well as the flight velocity. In the Composition B production line at Holston Army Ammunition Plant, interline distances greater than 130 feet between stainless steel tote bins conveying 168 pounds of Composition A-7 are unacceptable because of production requirements and equipment constraints.
Author (GRA)

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N78-17233 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 9, NO. 9
Sep. 1977 84 p refs
(AD-043832) Avail: Naval Research Laboratory, Washington, D. C. 20375 SVIC, Code 8404 Annual Rate $40.00 CSCL 20K

The acoustic vibration of structures in liquids was studied along with transient problems of structures interacting with fluid. A review of recent technical papers is included, dealing with beam vibration. For individual titles, see N78-17234 through N78-17236.

N78-17234 United Kingdom Atomic Energy Authority, Risley (England).
ACOUSTIC VIBRATION OF STRUCTURES IN LIQUIDS **c34**
D. Firth *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 9, No. 9 Sep. 1977 p 3-7 refs (For availability see N78-17233 08-31)
Avail: Naval Research Laboratory, Washington, D. C. 20375 SVIC, Code 8404 Annual Rate $40.00 CSCL 20K

The physics of the vibration of an elastic structure excited by sound waves in a liquid in contact with the structure are outlined. The historical background is summarized, and some recent literature is described. Examples include plates, ducts, and complicated engineering systems. Possible future developments are suggested.
Author

N78-17235 Illinois Univ. at Chicago Circle, Chicago.
SOME TRANSIENT PROBLEMS OF STRUCTURES INTERACTING WITH FLUID **c34**
Dusan Krajcinovic *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 9, No. 9 Sep. 1977 p 9-16 refs (For availability see N78-17233 08-31)
Avail: Naval Research Laboratory, Washington, D. C. 20375 SVIC, Code 8404 Annual Rate $40.00 CSCL 20K

Transient interaction problems involving either a constant wetted surface or an expanding or receding wetted surface are reviewed.
Author

N78-17236 Indian Inst. of Tech., Madras.
BEAM VIBRATIONS, A REVIEW **c39**
Hans Wagner and V. Ramamurti *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 9, No. 9 Sep. 1977 p 17-24 refs (For availability see N78-17233 08-31)
Avail: Naval Research Laboratory, Washington, D. C. 20375 SVIC, Code 8404 Annual Rate $40.00 CSCL 20K

Most structural elements encountered in practice can be treated as beams sacrificing little accuracy. For this reason, this review article summarizes work on the vibration of beams since 1973.
Author

N78-17237* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CLOSED LOOP SPRAY COOLING APPARATUS Patent
Donald L. Alger, William B. Schwab, and Edward R. Furman, inventors (to NASA) Issued 17 Jan. 1978 4 p Filed 31 Mar. 1976 Supersedes n76-20486 (14 - 11, p 1394)
(NASA-Case-LEW-11981-1; US-Patent-4,068,495; US-Patent-Appl-SN-672220; US-Patent-Class-62-376; US-Patent-Class-62-514R; US-Patent-Class-313-22) Avail: US Patent Office CSCL 13G

A closed loop apparatus for spraying coolant against the back of a radiation target is described. The coolant was circulated through a closed loop with a bubble of inert gas being maintained around the spray. Mesh material was disposed between the bubble and the surface of the liquid coolant which was below the bubble at a predetermined level. In a second embodiment, no inert gas was used, the bubble consisting of a vapor produced when the coolant was sprayed against the target.
Official Gazette of the U.S. Patent Office

N78-17238* National Aeronautics and Space Administration. Pasadena Office, Calif.
PURGING MEANS AND METHOD FOR XENON ARC LAMPS Patent
Charles G. Miller, inventor (to NASA) (JPL) Issued 30 Oct. 1973 7 p Filed 19 Jun. 1972 Sponsored by NASA
(NASA-Case-NPO-11978; US-Patent-3,769,544; US-Patent-Appl-SN-264268; US-Patent-Class-313-175; US-Patent-Class-313-176; US-Patent-Class-313-180; US-Patent-Class-313-184; US-Patent-Class-313-224) Avail: US Patent Office CSCL 13H

High pressure Xenon short-arc lamp with two reservoirs which are selectively connectable to the lamp's envelope is described. One reservoir contains an absorbent which will absorb both Xenon and contaminant gases such as CO2 and O2. The absorbent temperature is controlled to evacuate the envelope of both the Xenon and the contaminant gases. The temperature of the absorbent is then raised to desorb only clean Xenon while retaining the contaminant gases, thereby clearing the envelope of the contaminant gases. The second reservoir contains a gas whose specific purpose is, to remove the objectional metal film which deposits gradually on the interior surface of the lamp envelope during normal arc operation. The origin of the film is metal transferred from the cathode of the arc lamp by sputtering or other gas transfer processes.

Official Gazette of the U.S. Patent Office

N78-17239# National Aviation Facilities Experimental Center, Atlantic City, N. J.

FIRE DETECTION, EXTINGUISHMENT, AND MATERIAL TESTS FOR AN AUTOMATED GUIDEWAY TRANSIT VEHICLE Final Report, May - Aug. 1976

Richard G. Hill and George R. Johnson Nov. 1977 27 p refs (FAA Proj. 052-241-000)
(AD-A047789; FAA-NA-76-52) Avail: NTIS HC A03/MF A01 CSCL 13/12

Tests were conducted in a simulated automated guideway transit vehicle to determine the effectivity of a Halon 1301 fire extinguishing system during various types of fires, evaluate a photoelectric and an ionization fire detection system, and compare various materials under full scale fire conditions. A portion of a school bus supplied with an airflow system was used as the test article. Smoke density, temperature, carbon monoxide, and Halon 1301 concentrations were monitored throughout the tests. Hydrogen fluoride samples were taken during the fire extinguishing tests. The noise level associated with the activation of the explosive charge and release of the compressed gas from the 1301 reservoir was high; levels of 120-132 decibels were recorded. Halon 1301 was most effective when released within 1 to 2 seconds, to established the 5 percent by volume concentration. If slower release occur the Halon 1301 can be decomposed to HF, a toxic gas. Author

N78-17240# California Univ., Berkeley. Office of Research Services.

DESIGN CONSIDERATIONS FOR ASPHALT PAVEMENTS Final Report, 1 Jul. 1970 - 31 Mar. 1977

C. L. Monismith, K. Inkabi, D. B. McLean (Brooker (E. W.) and Associates, Calgary, Alberta, Canada), and C. R. Freeme (Natl. Inst. for Road Res., Pretoria) Mar. 1977 138 p refs Sponsored by DOT
(PB-274109/8; TE-77-1; FHWA/CA/TL-3153-77-30) Avail: NTIS HC A07/MF A01 CSCL 13B

Research pertaining to the fatigue response of asphalt paving mixtures, fatigue criteria to be used for design purposes, the effects of air void content and asphalt content on fatigue life, and the cracking of thick asphalt bound layers are discussed. The applicability of layered elastic theory to represent pavement response was studied. A subsystem which was used to predict permanent deformation on asphalt surfaced pavements using laboratory measured permanent deformation characteristics of paving materials and layered elastic theory is described. GRA

N78-17241# Colorado Univ., Boulder. Dept. of Economics.

ECONOMIC ANALYSIS OF THE NATIONAL MEASUREMENT SYSTEM

Barry W. Poulson Sep. 1977 44 p refs Sponsored by NBS
(PB-274049/6; NBSIR-75-948) Avail: NTIS HC A03/MF A01 CSCL 14B

The state of the art of economic analysis of the national measurement system was summarized. Measurement concepts for economic analysis, quantitative dimensions of measurement in the economy, and the relationships between measurement and economic change were studied. The measurement system from the standpoint of the private sector, including the economic rationale for measurement by producers, consumers, and in sales transactions; and case studies of costs and benefits were examined. The role of the government, incorporating an economic raionale for measurement activities in the public sector was investigated, and case studies of costs and benefits of activities by NBS were included. GRA

N78-17242# National Bureau of Standards, Boulder, Colo. Inst. for Basic Standards.

STRUCTURE AND FUNCTIONS OF THE NATIONAL MEASUREMENT SYSTEM

Raymond C. Sangster Jul. 1977 139 p refs
(PB-274048/8; NBSIR-75-949) Avail: NTIS HC A07/MF A01 CSCL 14B

The National Measurement System consists of the activities and mechanisms--intellectual and operational, technical and institutional that provide physical measurement data to allow creation of the objective, quantitative knowledge required by society. The structural and functional aspects of the system, are described with emphasis on the technical and institutional infrastructures, the international context, and basis impacts and trends. Appendices and an extended bibliography provide back-up detail for describing, predicting, communicating, deciding, controlling, and reacting in dealing with the physical universe. GRA

N78-17243# National Bureau of Standards, Washington, D. C. Inst. of Applied Technology.

A SURVEY OF THE NATIONAL METRIC SPEAKERS BUREAU

John M. Tascher Nov. 1977 60 p refs
(PB-273591/8; NBS-TN-960) Avail: NTIS HC A04/MF A01 CSCL 14B

The National Metric Speakers Bureau was established by the Metric Information Office of the National Bureau of Standards (NBS) in January 1976 in response to the rapidly growing interest in the metric system and metrication. The number of speakers at the end of 1976 was 273 with at least one in every state. A script and other materials was provided to each speaker. A survey of all of the speakers was conducted during November and December 1976 to determine how the speakers bureau is working, and how it can be made to work better. The findings of the survey were summarized. A survey of the sources of information on the metric system and metrication was also included. GRA

N78-17244# Louisiana Dept., of Transportation and Development, Baton Rouge. Research and Development Section.

ASPHALTIC CONCRETE OVERLAYS OF RIGID AND FLEXIBLE PAVEMENTS Interim Report, Oct. 1970 - Sep. 1977

Richard W. Kinchen and William H. Temple Sep. 1977 74 p refs Sponsored in part by DOT
(PB-274047/0; RR-109; LA-69-3B; FHWA-LA-RR-109; IR-1) Avail: NTIS HC A04/MF A01 CSCL 13B

The procedure used a deflection analysis to determine pavement rehabilitation needs. Design guides for selecting the overlay thicknesses are presented. Tolerable deflection-traffic load relationships and the deflection attenuation properties of asphaltic concrete were developed, representing the subgrade support conditions and properties of materials used in Louisiana. All deflection measurements on asphaltic concrete were corrected for the effect of temperature. Deflection measurements taken before and after overlay were also adjusted to minimize the effects of seasonal subgrade moisture variation. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N78-17245 Illinois Univ., Urbana-Champaign.

EFFECTS OF FADING ON A MULTI-USER SPREAD SPECTRUM SYSTEM USING DIRECT SEQUENCE MODULATION Ph.D. Thesis

John Andrew Orr 1977 150 p
Avail: Univ. Microfilms Order No. 77-26725

The effects of interference, as measured by signal to noise ratio and bit error rate at the receiver, were analyzed for cases with and without transmitted data on the interfering spread spectrum signal, and with and without fading. For some specific situations, numerical results were calculated. It is shown that in all cases considered, the addition of data and/or fading to an interfering direct sequence signal results in increased interference amplitude. Analytical expressions for interference power were developed for the limiting cases of very fast and very slow fading. Dissert. Abstr.

N78-17246 Stevens Inst. of Tech., Hoboken, N. J.
AN ANALYSIS OF ERRORS IN WAVE DIGITAL FILTERS Ph.D. Thesis
Daniel VanHaften 1977 306 p
Avail: Univ. Microfilms Order No. 77-26951

Roundoff noise characteristics of wave digital filters were analyzed with fixed-point arithmetic. Specific configurations which resulted in minimal roundoff noise were determined. Coefficient sensitivity properties were analyzed by determining individual multiplier coefficient sensitivities. Results were obtained for low pass, high pass, and a class of bandpass filters. In addition, filters built from adaptors with reflection-free ports were considered. The effects of scaling on roundoff noise were analyzed. It was determined that in general low pass filters built using adaptors with reflection-free ports had significantly greater roundoff noise than filters built using adaptors not containing reflection-free ports. Dissert. Abstr.

N78-17247 California Univ., Los Angeles.
PERFORMANCE ANALYSIS OF BANDLIMITED NONLINEAR SATELLITE CHANNELS Ph.D. Thesis
Leon Biederman 1977 249 p
Avail: Univ. Microfilms Order No. 77-25327

The performance of the satellite communication system was analyzed. A model for the SCS was adopted and the effect of the bandlimited environment in which the data transmission is taking place was discussed. The source and the user were linked by a bandlimited nonlinear channel with two independent noise sources, the uplink noise source before the nonlinearity and the downlink noise source after the nonlinearity. Two kinds of demodulators were analyzed. The first kind of demodulators, called Memoryless, make decisions based on the instantaneous received signal. The second kind of demodulator make decisions based on the entire received sequence. Average symbol error probability expressions were derived for these two kinds of demodulators for the uncoded satellite communication system with uplink noise and with zero uplink noise and for BPSK, QPSK and 8PSK modulation. Techniques to numerically compute these average symbol error probability expressions were also provided together with some practical examples. Dissert. Abstr.

N78-17248 British Broadcasting Corp., Kingswood (England). Research Dept.
A METHOD FOR MEASURING ECHOES IN THE MULTIPATH PROPAGATION OF U.H.F. SIGNALS
W. J. Christmas Jan. 1978 15 p refs
(BBC-RD-1978/1) Avail: BBC, Kinswood Warren, Tadworth, Surrey, England

A method of measuring the amplitudes and delays of the echoes encountered in the multipath propagation of radio waves was developed. The method uses a test signal transmitted on a spare line of a 405 line television signal and is therefore intended in the first place for use at V.H.F. The method could easily be extended to U.H.F. Author

N78-17249 British Broadcasting Corp., Kingswood (England). Research Dept.
SAMPLING FREQUENCIES AND STRUCTURES FOR SOLID STATE IMAGE SENSING IN BROADCASTING
G. M. LeCouteur Jan. 1978 10 p refs
(BBC-RD-1978/2) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Solid State Image Sensors are unlike present day camera tubes in that the light sensitive region is organized as discrete light sensitive elements each of which give rise to a distinct sample in the output video waveform. Because of this spatial sampling structure, and the resultant sampled nature of the signal, it has been suggested that there might be an advantage if the sampling frequency for the sensor were chosen to be the same as that used in any subsequent digital processing or signal distribution. The factors affecting the choice of sampling frequencies and structures for solid state sensors were examined. In general, there is no need to link the two sampling frequencies, and indeed, it will often be undesirable to do so. Author

N78-17250*# Stanford Univ., Calif. Center for Radar Astronomy.
RADAR SCATTERING LAWS AND WAVELENGTH DEPENDENCE OF THE LUNAR SURFACE
Richard A. Simpson 26 Jan. 1978 38 p refs
(Grants NsG-7029; NGL-05-020-014)
(NASA-CR-155714) Avail: NTIS HC A03/MF A01 CSCL 20N

Data from Apollo lunar bistatic radar experiments have been processed to give probability density functions for surface slopes. These show best agreement with a Hagfors scattering law, though data having both gaussian and exponential characteristics also exist. Surface roughness estimates range from 4 deg in maria to at least 8 deg in highlands, values which are appropriate to 25 m horizontal scales and which are areal averages over tens of square kilometers. Roughness varies with wavelength, most strongly in maria. Author

N78-17251*# Rasor Associates, Inc., Sunnyvale, Calif.
TELEC LASER EXPERIMENT
E. J. Britt Oct. 1977 53 p
(Contract NAS2-9109)
(NASA-CR-152077) Avail: NTIS HC A04/MF A01 CSCL 17I

An experimental thermoelectronic laser energy converter (TELEC) was constructed and tested with a 40 kW combustion laser operating at a wave length of 10.6 microns. The objective of the test was to demonstrate the feasibility of the TELEC concept for converting a laser beam into electric power. The TELEC System is intended as the receiver for a laser power transmission system in space. Author

N78-17252*# LinCom Corp., Pasadena, Calif.
Ku-BAND ANTENNA ACQUISITION AND TRACKING PERFORMANCE STUDY, VOLUME 4
T. C. Huang and W. C. Lindsey Oct. 1977 95 p
(Contract NAS9-14636)
(NASA-CR-151613; TR-7810-0675-Vol-4) Avail: NTIS HC A05/MF A01 CSCL 20N

The results pertaining to the tradeoff analysis and performance of the Ku-band shuttle antenna pointing and signal acquisition system are presented. The square, hexagonal and spiral antenna trajectories were investigated assuming the TDRS postulated uncertainty region and a flexible statistical model for the location of the TDRS within the uncertainty volume. The scanning trajectories, shuttle/TDRS signal parameters and dynamics, and three signal acquisition algorithms were integrated into a hardware simulation. The hardware simulation is quite flexible in that it allows for the evaluation of signal acquisition performance for an arbitrary (programmable) antenna pattern, a large range of C/N sub O's, various TDRS/shuttle a priori uncertainty distributions, and three distinct signal search algorithms. Author

N78-17253*# LinCom Corp., Pasadena, Calif.
HARDWARE SIMULATION OF SHUTTLE Ku-BAND ANTENNA ACQUISITION, VOLUME 5
T. C. Huang and W. C. Lindsey Oct. 1977 167 p
(Contract NAS9-14636)
(NASA-CR-151614; TR-7810-0675-Vol-5) Avail: NTIS HC A08/MF A01 CSCL 20N

For abstract, see N78-17252.

N78-17254*# Ohio State Univ., Columbus. Dept. of Geodetic Science.
EXPERIMENTS FOR IMPROVED POSITIONING BY MEANS OF INTEGRATED DOPPLER SATELLITE OBSERVATIONS AND THE NNSS BROADCAST EPHEMERIS
Manohar G. Arur Oct. 1977 143 p refs
(Grant NGR-36-004-204; OSURF Proj. 783820)
(NASA-CR-155735; Rept-258) Avail: NTIS HC A07/MF A01 CSCL 17B

An effort to improve station position recovery using broadcast ephemeris in Doppler data reduction was studied. A comparison of precise and broadcast ephemerides, treating the former as the standard, yielded information about the state disturbance that can be associated with the broadcast ephemeris. Statistical information about the state disturbance was used with current observational data for improved position recovery. The rank deficiency problem encountered in the short arc geodetic adjustment procedure was analysed and it was deduced that the fundamental rank deficiency is six, scale information being derivable from the wavelength of transmission. Coordinate differences between stations coobserving a pass are estimable. The uncertainty of the broadcast ephemeris, now in the WGS72 system, was assessed. It was conservatively estimated that its positional uncertainty may vary between 19 to 26 m in-track, 15 to 20 m cross-track and 9 to 10 m in radial directions depending on the incidence of the epoch of observations in the interinjection period. Author

N78-17255*# National Aeronautics and Space Administration, Washington, D. C.

DIFFERENT APPROACHES OF SPECTRAL ANALYSIS

J. L. Lacoume Oct. 1977 31 p refs Transl. into ENGLISH of "Differentes Approches de L'Analyse Spectrale", Rept. 20/77 Centre d'Etude des Phenomenes Aleatoires et Geophys., Inst. Natl. Polytech., Univ. Grenoble, Grenoble, 26 Apr., 1977 p 1-26 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-2790)
(NASA-TM-75224) Avail: NTIS HC A03/MF A01 CSCL 20N

Several approaches to the problem of the calculation of spectral power density of a random function from an estimate of the autocorrelation function were studied. A comparative study was presented of these different methods. The principles on which they are based and the hypothesis implied were pointed out. Some indications on the optimization of the length of the estimated correlation function was given. An example of application of the different methods discussed in this paper was included. Author

N78-17256# Lockheed Missiles and Space Co., Palo Alto, Calif.

ANALYSIS OF THE PECULIARITIES OF AUTOMATING THE PROCESSING OF MOIRE BAND MAPS

O. A. Levin and V. V. Sokolov [1978] 11 p refs Transl. into ENGLISH from Zavod. Lab. (USSR), no. 12, 1977 p 1504-1510
Avail: NTIS HC A02/MF A01; National Translation Center, John crerar Library, Chicago, Illinois 60616

The algorithm for automated processing of a moire map for determining strains and displacements using a digital computer includes: (1) scanning and analysis of the image in the specimen or article domain remote from the stress concentration; (2) displacement of the aperture at the next point of the map with coordinate x sub i, measurement of the integrated illumination I sub AB (x sub i) and determination of the quantity R sub AB(x sub i); and (3) determination of the frequency omega sub B(x sub i) of the raster B and the cumulative displacement [alpha sub B(x sub i) - alpha sub A(x sub i)] at the point x sub i. The results assures a programmed computation of the displacement and strain fields. J.C.S.

N78-17257# Army Engineer Topographic Labs., Fort Belvoir, Va.

BACKSCATTERING OF RADAR WAVES BY VEGETATED TERRAIN Technical Report, May 1974 - Oct. 1975

Richard A. Hevenor Jun. 1977 99 p refs
(AD-A047669; ETL-0105) Avail: NTIS HC A05/MF A01 CSCL 20/14

This report presents a vector theory for the backscattering of electromagnetic radar waves from vegetation. The basic technique employed in the solution required simulating the vegetation with a random medium. This medium possesses an electrical permittivity that is generated by a continuous random process and is characterized by a particular probability density function. A solution for the radar backscatter coefficient is obtained in terms of the statistical characteristics of the random medium. A comparison of the theory with experimental data is given. Insight is given into the nature of depolarization, but explicit results for the depolarized terms are not obtained at this time because of the complexity and difficulty of the solution. Some of the conclusions of this work are: a theory has been developed for computing the like polarized (HH and VV) radar backscatter coefficients from certain types of vegetation by using a vector renormalization approach; no rigorous quantitative comparison of theory with experiment was possible; however, qualitative comparisons indicate reasonable agreement; and although no explicit solution was obtained for the depolarization components, it was learned that one cause of depolarization is the anisotropy associated with the correlation function of the dielectric fluctuations. Author (GRA)

N78-17258# Harry Diamond Labs., Adelphi, Md.

CONFORMAL DIELECTRIC-FILLED EDGE-SLOT ANTENNAS FOR BODIES OF REVOLUTION

Daniel H. Schaubert, Howard S. Jones, Jr., and Frank Reggia Sep. 1977 27 p refs
(AD-A047765; HDL-TR-1837) Avail: NTIS HC A03/MF A01 CSCL 09/5

A class of circumferential-slot antennas that are ideally suited for conformal mounting on conducting bodies of revolution has been developed. The simplest form of the antenna is a disk of dielectric substrate that is copper-plated on both sides and mounted between two parts of the conducting body so that the aperture coincides with the surface. The antenna is excited by a single coaxial stub at the center and is tuned for proper operating frequency by inductive posts that connect the two copper-plated sides of the disk. By varying the number and location of the inductive posts, the operating frequency of a single antenna can be tuned over a six-to-one range. In practice, plated-through holes are used as inductive posts in order to provide mounting and access holes. The single coaxial feed excites azimuthally symmetric fields that are not significantly distorted by the symmetrically placed inductive posts. Therefore, radiation patterns of edge-slot excited bodies display a high degree of azimuthal symmetry. The small size, light weight and inexpensive fabrication procedure make the edge-slot attractive for many applications. Author (GRA)

N78-17259# Army Engineer Topographic Labs., Fort Belvoir, Va.

BACKSCATTERING OF RADAR WAVES FROM A TILTED, SLIGHTLY ROUGH SURFACE

Richard A. Hevenor Jun. 1977 42 p refs
(AD-A047668; ETL-0124) Avail: NTIS HC A03/MF A01 CSCL 20/14

This report presents the derivation of an equation for the radar backscatter coefficient from a tilted, slightly rough surface. The basic technique employed in the solution is the small perturbation method, along with the Fourier transform. The incident wave is allowed to have an arbitrary polarization, and specific results are shown for horizontal, vertical, circular, and elliptical polarizations. One conclusion of this report is that the influence of a given slope of the tilted rough surface, upon the calculation of the radar backscatter coefficient, depends upon the polarization of the incident electromagnetic wave.
Author (GRA)

N78-17260# Naval Research Lab., Washington, D. C.

A SHORT-PULSE AREA MTI Interim Report

Ben H. Cantrell 22 Sep. 1977 12 p refs
(AD-A047419; AD-E000033; NRL-8162) Avail: NTIS HC A02/MF A01 CSCL 17/9

Slow-moving and fast-moving objects can be discriminated between by noncoherently subtracting the video return of a pulse of a short-pulse radar from the video return of the preceding pulse. Under the condition of the scattering object acting as a point target, the probability of detection versus object speed for various signal-to-noise ratios and a fixed probability of false alarm was found. The results showed low detectability for slow-speed targets and high detectability for higher speed targets. The velocity range of low detectability was a function of signal-to-noise ratio. This moving-target detector does not have velocity or range ambiguities, as often is the case with moving-target detectors based on Doppler processing. Author (GRA)

N78-17261# California Univ., Los Angeles. Dept. of Computer Science.

ADVANCED TELEPROCESSING SYSTEMS Semiannual Technical Report, 1 Jan. - 30 Jun. 1977
Leonard Kleinrock, Gerald Estrin, Richard Muntz, and Gerald Popek
30 Jun. 1977 192 p refs
(Contract DAHC15-73-C-0368)
(AD-A047496) Avail: NTIS HC A09/MF A01 CSCL 17/2

This research deals with the transmission of stream traffic through packet switched networks. Stream traffic communication is characterized by (1) a requirement of small response time and moderate throughput, the fact that (2) timing is an integral part of the information and that (3) the information is redundant and somewhat tolerable to loss. Remote voice communication provides an example of stream traffic communication. Traditional dedicated communication systems supporting stream traffic have exhibited fixed capacity and fixed delay. In such systems each user is assigned a communication link whose capacity is large enough to support that user's peak load. While timing is easily preserved by such systems, it is difficult to share communication links. This research explores systems in which the communication channels are shared among many users, thus causing delay and capacity to vary. GRA

N78-17262# Rome Air Development Center, Griffiss AFB, N.Y.
DETECTION OF TARGETS IN NOISE AND CLUTTER
Ronald L. Fante Jul. 1977 39 p refs
(AD-A047535; RADC-TR-77-243) Avail: NTIS HC A03/MF A01 CSCL 17/9

We have calculated the probability of detecting either a Swerling-1 or Swerling-2 target immersed in both Rayleigh noise and log-normally distributed clutter. Results are presented which indicate the effect on detection of the number of pulses integrated, signal-to-noise ratio and the noise-to-clutter ratio. Author (GRA)

N78-17263# Colorado Univ., Boulder. Electromagnetics Lab.
RADIATION FROM A CIRCULAR BEND BETWEEN TWO DISCONTINUITIES IN OPEN WAVE GUIDING STRUCTURES Interim Technical Report
S. W. Maley Jul. 1977 34 p refs
(AD-A047525; Scientific-3; RADC-TR-77-245) Avail: NTIS HC A03/MF A01 CSCL 09/5

Surface waveguides radiate energy at bends. The asymptotic problem of solving for the radiated power and the radiation pattern for large radius of bend have been studied theoretically for the slab waveguide and for the circular cylindrical waveguide. The slab configuration consists of two semi-infinite slabs joined by a circular bend. The cylindrical configuration consists of two straight circular cylinders joined by a circular bend. The results indicate that the discontinuities at the transitions between the straight sections and the bend cause the radiation to differ significantly from the radiation of a bend of the same size but being part of a uniform circular structure rather than being joined to two straight sections. The radiated power for both the slab and circular cylinder configurations is found to vary inversely as the square of the radius of curvature, and the radiation pattern is composed of many closely spaced narrow lobes. As the radius of curvature of the bend increases the lobes become more numerous and more closely spaced. The results can be extended for use to calculate approximate power loss due to radiation from bends in open waveguides in close proximity to the earth. Author (GRA)

N78-17264# Naval Ocean Systems Center, San Diego, Calif.
EFFECTIVE ELECTRON DENSITY DISTRIBUTIONS DESCRIBING VLF/LF PROPAGATION DATA Technical Report, Jan. 1973 - Jun. 1977
D. G. Morfitt 21 Sep. 1977 106 p refs
(AD-A047508; NOSC/TR-141) Avail: NTIS HC A06/MF A01 CSCL 20/14

This report presents VLF/LF field strength measurements obtained between 9 and 60 kHz for several radio propagation paths. These include several radials outward from Hawaii, several transmission paths across the continental United States, and high latitude propagation over the Greenland Ice Cap. Effective exponential electron density profiles are derived yielding predicted signal levels that simulate the experimental data. Author (GRA)

N78-17265# Naval Research Lab., Washington, D. C.
THROUGHPUT PERFORMANCE OF DATA-COMMUNICATION SYSTEMS USING AUTOMATIC-REPEAT-REQUEST ARQ ERROR-CONTROL SCHEMES Interim Report
Joel M. Morris 8 Sep. 1977 38 p refs
(AD-A047412; AD-E000038; NRL-8140) Avail: NTIS HC A03/MF A01 CSCL 17/2

The throughput performance of several ARQ schemes was evaluated. The purpose is to provide data-communication design engineers with information to help them choose error-control techniques or to assess the performance of their proposed ARQ or hybrid designs. The schemes considered included the stop-and-wait, the go-back-N, and the selective-repeat schemes and some variations of these. In addition, the performance of a hybrid scheme that uses the best properties of both the ARQ scheme and the forward-error-correction (FEC) scheme was assessed. Most of the equations derived for computing throughput efficiency (eta) or optimal blocklength were obtained as direct modifications or extensions or equations found in the published literature. The equations were derived primarily for random-error channel models, although some burst-error conditions were considered. Among items yet to be studied are the optimal transmission rate and blocklength to maximize the throughput (in bits per second). Author (GRA)

N78-17266# Science Applications, Inc., Berkeley, Calif.
SELECTED TROPICS IN TRANSMISSION-LINE THEORY FOR EMP INTERNAL INTERACTION PROBLEMS Final Report
F. M. Tesche and T. K. Liu Kirtland AFB, N. Mex. AFWL Aug. 1977 100 p refs
(Contract F29601-76-C-0125)
(AD-A047396; AD-E200044; AFWL-TR-77-73) Avail: NTIS HC A05/MF A01 CSCL 20/14

This report discusses a number of modifications of a single wire transmission line model for use in EMP internal interaction studies. The importance of including the effects of local line perturbations (such as a cable clamp) is discussed in terms of the reflection coefficient presented to waves on the transmission line, and general curves for determining when to neglect such effects are given. Next, the behavior of a finite length transmission line with periodic loading is investigated and results are compared with those of an infinite line using Floquet's theorem. Finally, the bulk current response of a general multi-conductor transmission is related to the current on a single wire line and a prescription for determining an equivalent single wire characteristics impedance and a load impedance from the multiconductor quantities is described. Author (GRA)

N78-17267# General Electric Co., Syracuse, N.Y. Electronic Systems Div.
UNATTENDED/MINIMALLY ATTENDED RADAR STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Technical Report, 1 Jul. - 30 Nov. 1976
Thomas B. Shields, S. E. Bell, M. I. Fox, L. D. Hayes, and R. V. Jackson Griffiss AFB, N. Y. RADC Aug. 1977 30 p
(Contract F30602-76-C-0380)
(AD-A044273; RADC-TR-77-263-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 17/9

The Executive Summary is a very short synopsis of the Unattended/Minimally Attended Radar Study to investigate the exploratory and advance development activities necessary to support the development of Unattended and Minimally Attended Radars. The study looked at several 2-D and 3-D radar designs. The primary considerations were high reliability and low-life cycle cost, with the additional constraint that the 2-D Unattended Radars were to use no more than approximately 500 W of prime power. The conclusion of the study is that the technology is available, in 1977, to permit development of Unattended (for 1 to 3 months) 2-D radars and Minimally Attended (3 radar maintenance men) 3-D Radars. Designs are discussed in the report which permit the 2-D radar to perform its mission while utilizing only 400 W of prime power. Author (GRA)

N78-17268# Air Force Weapons Lab., Kirtland AFB, N. Mex.
UHF PROPAGATION EFFECTS IN SCINTILLATED ENVIRONMENTS Final Report

Leon A. Wittwer, Ted Salvi, and Erle Pettus Aug. 1977 73 p refs Sponsored by DNA
(AD-A047395; AFWL-TR-76-304) Avail: NTIS HC A04/MF A01 CSCL 17/2

Calculational methods for examining the effects of striations on UHF signals are presented. The advantages of each method are discussed. Calculations are presented which illustrate the various expected effects on signals from different striation structures. The calculations demonstrate that for ambient environments Rayleigh signal statistics are a reasonable worst case representation. It is also shown that for most cases of interest the ionospheric fluctuation power spectral density or its equivalent is necessary and sufficient to calculate the required signal effects. Author (GRA)

N78-17269# Naval Training Equipment Center, Orlando, Fla.
CROSS-SCAN INVESTIGATION FOR CLOSED CIRCUIT TELEVISON Final Report, Jun. 1974 - Jan. 1975
John W. Herndon Jun. 1977 19 p
(AD-A047920; NAVTRAEQUIPC-IH-293) Avail: NTIS HC A02/MF A01 CSCL 17/2

Line structure resulting from the generation of a television raster is distracting in visual displays used for simulating real world scenes. The objective of this investigation was to seek a possible solution to the problem by means of utilizing cross-scan raster generation. It was hypothesized that the resulting grids would break up the solid straight line pattern and give a more uniform and less conspicuous appearance to the display. Additionally, an increase in picture information was expected due to the increased area scanned. Five different cross-scan schemes were investigated. While each method yielded an increase in area coverage and, therefore, an increase in picture information, sub-area flickering was a problem in all but one. It was concluded that the cross-scanning technique can produce a flicker-free raster with a more pleasing and somewhat less conspicuous pattern. To achieve any significant improvement in line structure appearance with the cross-scanning technique, it is necessary to start at double the scan number for any given standard scan number for which a comparison is to be made. As the scan number is increased, the bandwidth must also be increased and system noise becomes more of a problem. In light of these findings, it was further concluded that cross-scanning can provide an improvement at the lower scan numbers, but this improvement diminishes for the higher scan numbers. Author (GRA)

N78-17270# Pennsylvania Univ., Philadelphia. Valley Forge Research Center.
MEASUREMENT OF THE SPATIAL CORRELATION FUNCTION OF AN HF WAVE AFTER PASSAGE THROUGH THE IONOSPHERE Final Report
Bernard D. Steinberg and S. Hassan Taheri Dec. 1977 16 p
(Contracts N00014-75-C-1178; N00014-67-A-0216-0033)
(AD-A047915; VFRC-122) Avail: NTIS HC A02/MF A01 CSCL 17/9

Experimental equipment was designed, built, and used in an experiment for the purposes of acquiring data, performing analyses, testing algorithms, and evaluating system characteristics for measurement of the spatial correlation function of the phase of an HF wave after passage through the ionosphere. For the test, 8 phase-synchronized receivers were designed and built, distributed randomly over a 40-kilometer baseline, and used to receive HF signals from a transmitting site some 2500 kilometers distant. Raw data in excess of 10 to the 8th power bits were collected. Author (GRA)

N78-17271# McDonnell-Douglas Corp., St. Louis, Mo.
ADVANCED RECEIVER MODELING METHODS Final Report, 30 Jun. 1975 - 31 Aug. 1976
Saul Fast Sep. 1977 120 p refs
(Contract F33615-75-C-1265)
(AD-A048041; AFAL-TR-76-265) Avail: NTIS HC A06/MF A01 CSCL 17/2

This program develops an advanced methodology to aid the design, test and evaluation of receiver systems. Computer programs were developed for treating receiver performance degradations due to noise, nonlinearities, linear distortion, and signal interference. Specifically, two computer programs were generated for treating receiver processes encountered in signal paths and synthesizers respectively. Signal path computations are made relative to the receiver frequency plan, receiver noise figure and sensitivity performance, second and third order receiver intermodulation intercepts, permissible two sinusoid signal levels and dynamic range performance. Spurious response performance is computed for each spur product type generated at each mixer, yielding the worst case spur frequency and spur signal level at the receiver input and the corresponding worst case set of mixer local oscillator frequencies. Computations are also made of the receiver output waveform response to an essentially arbitrary input signal waveform. Synthesizer program computations are made of the frequency plan, worst case phase modulation of each synthesizer output by spurious products generated at each phase comparator and mixer and worst case phase modulation of each synthesizer output by noise generated on each VCO and in the phase locked loop circuits. GRA

N78-17272# IRT Corp., San Diego, Calif.
USER'S MANUAL FOR THE DYNASPHERE SGEMP COMPUTER CODE Progress Report, Sep. 1975 - Jun. 1976
Andrew J. Woods 14 May 1976 36 p refs
(Contract DNA001-76-C-0068)
(AD-A047959; AD-E300045; INTEL-RT-8141-029; DNA-3996T) Avail: NTIS HC A03/MF A01 CSCL 20/14

The DYNASPHERE computer code for solution of SGEMP problems in spherical geometry, including space-charge-limited currents, is described. Emphasis is given to details of employing the code in modeling problems. A brief overview of code capabilities is provided. Computer requirements are listed, input cards are described, and a sample problem provided. Code outputs and other variables are defined in a glossary. Author (GRA)

N78-17273# Atlantic Research Corp., Alexandria, Va.
SPECIAL EMC AND DEGRADATION MEASUREMENTS ON THE AN/SPS-55 RADAR SET
23 Sep. 1977 68 p refs
(Contract N00024-76-C-7060)
(AD-A047863) Avail: NTIS HC A04/MF A01 CSCL 17/9

The measurements performed, divided into two general categories, are summarized. The equipment reference performance measurements provide information for correlating the interference validation measurement results, one to another and to compare to existing measured data. The sensitivity and dynamic range measurements include the characteristics at two receiver output test points; (1) IF output before detection and (2) the PPI video output. Also, the dynamic range was measured with the output taken at the first available video test point following the detector. Test signal modulations included representative shipboard interference signals as well as the nominal AN/SPS-55 values. GRA

N78-17274# Pittsburgh Univ., Pa. Dept. of Physics and Astronomy.
IONIC AND NEUTRAL REACTIONS RELEVANT TO COMMUNICATIONS AND IONOSPHERIC PROCESSES Final Report, 30 Sep. 1976 - 30 Mar. 1977
Wade L. Fite and Frederick Kaufman 15 Aug. 1977 10 p refs
(Grant DAAG29-76-G-0342)
(AD-A047876; ARO-14620.1-C) Avail: NTIS HC A02/MF A01 CSCL 07/4

A brief review of data on identifying important ions following associative ionization processes of U and Th has indicated that UO2(+) and ThO2(+) are probably the respective terminal ions in atmospheric processes. These ions are either formed directly or are produced by the ion-molecule reaction MO(+) + O2 yield MO2(+) + O. Two contributions were made to the field of neutral-neutral processes: to aid vibrational relaxation measurements on HX species, a pre-titration flow tube system was built which provides simple and accurate measurements of H-atom densities; and a tunable dye laser wavelength narrowing attachment was put into operation which makes possible the measurement of OH densities at = or > 10 to the 8th power/cu cm. This has been used to determine the rate constant of an atmospherically important reaction of the HO2 radical.
Author (GRA)

N78-17275# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.

ON SOME ASPECTS OF RANDOM WALKS FOR MODELLING MOBILITY IN A COMMUNICATION NETWORK

S. K. Leung-Yan-Cheong and E. R. Barnes Nov. 1977 18 p (Contract N00014-75-C-1183)

(AD-A047874; ESL-P-783) Avail: NTIS HC A02/MF A01 CSCL 12/1

This note examines a two-dimensional symmetric random walk model of mobility for terminals in a communication network. A stochastic process associated with the location of a terminal is defined. For a certain location finding scheme, the mean time between terminal transmissions is derived. A first-order analysis is given of the trade-off between the amount of location related data to be transmitted per unit time and the accuracy about the terminals' positions. GRA

N78-17276# Ohio State Univ., Columbus.

SYNTHESIS AND OPTIMIZATION FOR ARRAYS OF NONPARALLEL WIRE ANTENNAS BY THE ORTHOGONAL METHOD

Jun. 1977 37 p refs

(Contract N00014-76-C-0573)

(AD-A047936; ESL-4372-3) Avail: NTIS HC A03/MF A01 CSCL 09/5

The orthogonal method is presented for synthesis and optimization problems of arrays of straight, nonparallel, thin-wire antennas. First by the moment method the far zone field and the performance indices of the array are represented by expressions useful for applying the orthogonal method. By a procedure similar to Gram-Schmidt method, the far zone field and the indices of the array are modified. The new expressions by a suitable procedure give helpful formulas for synthesis and optimization. Several examples for possible uses are included. Author (GRA)

N78-17277# Georgia Inst. of Tech., Atlanta. School of Electrical Engineering.

SYSTEM PERFORMANCE ASSESSMENT AND CONTROL CONCEPT (SYPAC)

Robert Feik Oct. 1977 435 p

(Contract F30602-75-C-0118)

(AD-A047896; RADC-TR-77-337) Avail: NTIS HC A19/MF A01 CSCL 17/2

The SYPAC report is the result of nine years of research on system performance assessment and control, buttressed by field measurements, operational evaluations, and special studies. The resultant output is a System Performance Assessment and Control (SYPAC) concept suitable for implementation in the Defense Communications System (DCS). Specific examples of the problems faced in a wide flung communication systems such as the DCS are given along with some of the procedures to identify, isolate, and quantize the difficulty. The use of Automated Tech Control (ATEC) hardware is demonstrated to portray the capability offered by this automated sensing assembly. Selected printouts are provided to clarify these examples. The rationale is given for the approach selected and the impact is presented on the operations, organization, analysis, software, hardware, and orderwire activities of the Air Force and DoD. The SYPAC concept is a communication system control approach where the control mechanism derives its instructions from processed data based upon performance assessments. The SYPAC report is written in non-scientific terms so that high level managers as well as working level programmers and staff agencies can quickly grasp the approach and intent. Thus, it can be used as a general policy guide for management and staff actions at all levels. Certain portions may be overly detailed for those people who have in-depth knowledge of the Air Force or the DCA Performance Assessment Programs, but in general, it is written for all people who operate, manage, or maintain the DCS. GRA

N78-17278# Rome Air Development Center, Griffiss AFB, N.Y.

SEEK IGLOO RADAR CLUTTER STUDY

William L. Simkins, Vincent C. Vannicola, and James P. Ryan Oct. 1977 131 p refs

(AD-A047897; RADC-TR-77-338) Avail: NTIS HC A07/MF A01 CSCL 17/9

This report presents the procedures and results of a clutter measurement program conducted in Alaska during the summer of 1976. Both amplitude and spectral density functions were modeled from the data taken from land, sea, weather, and other forms of clutter. Sectors over which clutter was measured varied in size and in roughness, and, consequently, gave rise to density functions, ranging from log-normal, where major shadowing did not occur, to heavily contaminated-normal with large regions of shadowing. Reflectivity for 50 to 84 percentile characterizing the worst case terrain features are also presented. Author (GRA)

N78-17279# Army Engineer Topographic Labs., Fort Belvoir, Va.

SCATTERING OF A CODE-MODULATED RADIO SIGNAL AND ASSOCIATED MULTIPATH RANGE ERRORS

Eugene A. Margerum and Frederick W. Rohde Jan. 1977 43 p

(DA Proj. 4A1-61102-B-52C)

(AD-A047824; ETL-0125) Avail: NTIS HC A03/MF A01 CSCL 17/2

To account for range errors obtained when a code-modulated radio signal is used to make range measurements in a scattering environment, a mechanism termed 'carrier cancellation' is proposed. This allows for destructive interference between several nearly direct path signals, leaving the possibility for a weaker signal that has traveled over a longer path to predominate. A mathematical formulation of the phenomenon is given, and the equations derived are used for a computer simulation of the effects. The results of the simulation confirm that the proposed mechanism represents a viable explanation of the observed range errors. Author (GRA)

N78-17280# Helsinki Univ. of Technology, Espoo (Finland). Radio Lab.

CALCULATION OF THE EFFECTS OF DEW ON RADOME PERFORMANCE

David E. Meharry 1977 28 p refs

(Rept-S-98; ISBN-951-751-044-6) Avail: NTIS HC A03/MF A01

It has been noted that the formation of dew on the outside of a radome adversely affects its performance, often to a severe degree. A theoretical treatment of the problem is reported, starting with a flow graph analysis of the multilayered air-dew-radome-air structure and then integrating the results over the antenna aperture. Numerical calculation of both emission and transmission at 22.2 and 78 GHz show at least qualitative agreement with measurements. Quantitative agreement cannot be checked until the development of a method for directly measuring dew thickness on the radome, for which a possible solution is also presented. Author (ESA)

N78-17281# Technical Univ. of Denmark, Lyngby. Lab. of Electromagnetic Theory.

A STUDY OF INTERFERENCE IN SATELLITE BROADCASTING

E. VoelJensen Aug. 1977 55 p refs

(TUD-R-188) Avail: NTIS HC A04/MF A01

The World Administrative Radiocommunications Conference (WARC), Geneva 1977, approved a plan for satellite TV broadcasting. Now a computer model simulating a system of co-channel and adjacent channel satellite transmitters is presented. Introductory investigations of interference problems were performed in selected case studies comprising a system of 17 co-channel satellite transmitters in a regular configuration and a model of channel 12 of the WARC plan. A special tool (the interference picture) for analyzing the interference at a given receiver location is described. Author (ESA)

N78-17282# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.

ELECTROMAGNETIC SHIELDING, SOME SIMPLE FORMULAE FOR CLOSED UNIFORM SHIELDS

Erling Dahlberg Dec. 1975 86 p refs

(TRITA-EPP-75-27) Avail: NTIS HC A05/MF A01

Electromagnetic shields should be adequate without incurring undue cost or weight. A number of formulas are collected that are consistent with electromagnetic theory. Such formulas will in many cases give shielding estimates quite different from what

would be obtained from the use of engineering formulas as presented in widespread handbooks and shielding manuals. The classical, but often distorted, quasistatic formulas for sphere and infinite circular cylinder with internal or external source are complemented by estimates for a finite circular cylinder with closed ends and for the coupling between two (coaxial or coplanar) coils on either side of an infinite plane shield. Formulas and diagrams are also given for double and multiple shields where the shells may be of different materials. In addition to these quasistatic cases, formulas are also given for the penetrating field when a plane wave is (obliquely) incident on an infinite plane shield or an infinite circular cylinder. For each material it is assumed that the relative permeability is much higher than unity. Author (ESA)

N78-17283# Technical Research Centre of Finland, Helsinki. Electrical Engineering Lab.
INERTIAL PARTIAL DISCHARGES - PULSE DISTRIBUTIONS, PHYSICAL MECHANISMS AND EFFECTS ON INSULATIONS Ph.D. Thesis - Helsinki Univ. of Technol.
Seppo Kaerkkaeinen 26 Apr. 1976 125 p refs Sponsored by Finn. Cultural Found.
(VTT-ENT-14; ISBN-951-38-0331-7) Avail: NTIS HC A06/MF A01

The possibilities of a multichannel pulse analyzer in partial discharge studies are discussed. For this purpose the measurement and computer treatment of amplitude distributions, phase angle distributions, and pulse interval distributions of apparent charge pulses were studied. The occurrence mechanisms of internal partial discharges were examined. The basic mechanism is a single electron avalanche across the cavity which can be followed by secondary surface discharges on the surfaces of the cavity. Sometimes, successive electron avalanches also occur across the cavity, especially if the cavity is adjacent to an electrode. Current pulses, measured using a sampling oscilloscope, and different distributions of apparent charge pulses, were studied on the basis of the discharge mechanisms. Performance of long term aging tests for insulations under partial discharges was investigated. In connection with the performed measurements, the temporal variation of discharge pulses was noted to result mainly from the changes in the surface resistance of the cavity. The degradation of the insulation occurred in the form of crater like pits in the cavity. The existence of these pits did not manifest itself in the discharge pulses. The Weibull distribution was noted to be quite suitable for the study of breakdown times. In a closer study of the breakdown probabilities, it was noted that the lengthening of the life times when the field strength decreased, resulted mainly from the change in the discharges. On the other hand the electric strength of the insulation remained approximately constant in partial discharge tests. Author (ESA)

N78-17284# Technische Universitaet, Munich (West Germany).
TIME AND FREQUENCY BEHAVIOR OF GaAs LIGHT EMITTING DIODES FOR OPTICAL COMMUNICATION SYSTEMS [ZEIT- UND FREQUENZVERHALTEN VON GaAs LEUCHTDIODEN FUER OPTISCHE NACHRICHTENSYSTEME]
W. Huber Bonn DOKZENTBw 1977 94 p refs In GERMAN; ENGLISH summary
(Contract T/RF-31/RT-310/41050)
(BMVg-FBWT-77-11) Avail: NTIS HC A05/MF A01; DOKZENTBw DM 30

Theoretical and experimental investigations were carried out. A model was developed, which allows calculation of the rise time and modulation bandwidth of homostructure and single heterostructure light emitting diodes (LED's) as a function of active-layer doping, and width, active area, and diode current. The pulse behavior and modulation bandwidth of LED's with systematically varied technological parameters was measured and compared with calculated values. It is concluded that the modulation bandwidth can be extended to the GHz range.
Author (ESA)

N78-17285# Geological Survey, Denver, Colo.
CALCULATION OF STANDARD TRANSIENT AND FREQUENCY SOUNDING CURVES FOR A HORIZONTAL WIRE SOURCE OF ARBITRARY LENGTH Final Report
James Kauahikaua and Walter L. Anderson 1977 63 p refs
(PB-274119/7; USGS-GD-77-007) Avail: NTIS HC A04/MF A01 CSCL 08I

A Honeywell multics FORTRAN 4 program was described for numerically computing all Cartesian components of both electric and magnetic fields about a grounded horizontal electric dipole, a finite wire source of arbitrary length, or an infinite wire for the quasistatic case over an isotropic horizontally stratified earth. Closed form expressions and rapid numerical methods were developed to compute the fields about the finite length grounded wire. The fields may be computed as functions of time or frequency. The program listing, documentation, and some example terminal sessions were included. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N78-17286 Florida Univ., Gainesville.
MODELING AND OPTIMIZATION OF METAL-OXIDES-SEMICONDUCTOR FIELD-EFFECT TRANSISTOR LARGE-SCALE INTEGRATED CIRCUITS Ph.D. Thesis
Donald Lambert Fraser, Jr. 1977 362 p
Avail: Univ. Microfilms Order No. 77-25926

The device model selection scheme is based upon evaluation of the computational efficiency as well as the accuracy of each model in a library of device models. Computational efficiency, or model complexity, is measured in terms of the device model time per pass, which accounts for the time spent by the simulation program in evaluating the nonlinear elements. Model accuracy is measured in terms of the model's ability to predict dc steady state and transient behavior. The schemes for selecting a particular MOSFET device model from the library of models involve a trade off between accuracy and computational efficiency.
Dissert. Abstr.

N78-17287 Michigan Univ., Ann Arbor.
A VERTICAL JUNCTION FIELD-EFFECT TRANSISTOR-FABRICATION AND ANALYSIS Ph.D. Thesis
Donald Charles Mayer 1977 292 p
Avail: Univ. Microfilms Order No. 77-26304

A technique was proposed for fabricating a submicron channel vertical junction field effect transistor (JFET) using silicon batch processing techniques and standard photolithography. The short channel length of this device is expected to make it useful for microwave applications as well as for highspeed integrated circuits. The fabrication procedure is easily modified for use with compound semiconductors to take advantage of the higher mobilities and greater carrier velocities available in other materials. A finite element numerical simulation of the JFET operation was performed using a FORTRAN program run on an AMDAHL 470 computer. The numerical simulation predicts pentode-like common source output characteristics for the pn JFET. Dissert. Abstr.

N78-17288 Arizona State Univ., Tempe.
COMPOSITE BIPOLAR AND FIELD EFFECT CARRIER DOMAIN DEVICES Ph.D. Thesis
Augustin Ochoa, Jr. 1977 157 p
Avail: Univ. Microfilms Order No. 77-26960

An investigation and analysis are presented of a concept in electronic function generation: the carrier domain device (CDD). Distributed and proximity effects were used to produce a CDD which is an elongated bipolar structure made to inject emitter current preferentially in localized, movable domains. Device characterization, analysis and applications are presented.
Dissert. Abstr.

N78-17289 Illinois Univ., Urbana-Champaign.
TRANSFORMATION OF BOOLEAN EQUATIONS FOR THE DESIGN OF MULTIPLE-OUTPUT NETWORKS

Ph.D. Thesis
Warren Clark Pratt 1977 132 p
Avail: Univ. Microfilms Order No. 77-26735

The major topics of discussion are: (1) the development of transformations from general systems of the form f(x,z) = g(x,z) to systems of the form z = h(x,z); (2) theory application to the design of multiple-output networks; (3) the development of computational algorithms for the implementation of the transformation techniques; (4) the development of an analysis technique for the detection of steady oscillations in combinational networks and in asynchronous sequential networks; (5) the development of an approach to the design of networks containing direct, cascade, and closed-loop forms; and (6) the provision of an understanding of combinational logic networks containing closed-loops. Dissert. Abstr.

N78-17290 Stanford Univ., Calif.
DESIGN AND APPLICATIONS OF DIGITAL FILTERS Ph.D. Thesis
Kishan Shenoi 1977 118 p
Avail: Univ. Microfilms Order No. 77-25724

Time domain methods for the design of recursive digital filters using a squared error criterion were compared with a frequency domain technique. Levy's method was formulated to obtain design equations for digital filters. A special case of Levy's method was shown to be essentially equivalent to the time domain methods. Strategies for compressing speech signals for transmission and storage were discussed. The first step was derived as a filter design problem. Coding techniques used in the second step were shown to give insight into structural considerations for realizing digital filters. A change of variables was described which transforms the problem of designing a recursive digital filter to that of approximation by a ratio of polynomials on a finite interval. Some analytic techniques for the design of low pass filters are presented illustrating the use of the transformation. Dissert. Abstr.

N78-17291 Massachusetts Univ., Amherst.
MODELING OF ELECTRICAL AND THERMAL INSTABILITIES IN A BIPOLAR TRANSISTOR UNDER REACTIVE CIRCUIT CONDITIONS Ph.D. Thesis
Luke Joseph Turgeon 1977 145 p
Avail: Univ. Microfilms Order No. 77-26438

The current density and temperature distribution in a bipolar power transistor operating in the switching mode under transient conditions has been computed as a function of circuit environment. A modeling was done of the turn-off of the transistor in a circuit containing resistive and inductive elements. Of particular interest was the study of the local current and temperature distribution achieved in the transistor during turn-off in a circuit with a large inductance: in the process of shut-off this inductance maintains the transistor collector current at a high value as the collector junction undergoes avalanche multiplication due to the high voltage induced across this junction by the inductive load. The method of computation was to solve numerically the electrical carrier flow as well as Poisson and the heat flow equations in a two-dimensional model n(+)-p-n-n(+) of a transistor structure as a function of time. Dissert. Abstr.

N78-17292 Kansas Univ., Lawrence.
AN INVESTIGATION OF LIGHTNING DAMAGE TO NONMETALLIC COMPOSITE AIRCRAFT MATERIALS AND ASSOCIATED PROTECTIVE SYSTEMS Ph.D. Thesis
Steven Ames Lorenz 1977 140 p
Avail: Univ. Microfilms Order No. 77-29190

The inherent dangers of operating aircraft equipped with nonmetallic components within the natural lightning environment are described. A philosophy for simulating the natural lightning current waveform is presented and a circuit to produce simulated waveforms is proposed. A chronicle of the design construction, and operation of a simulation facility based on this circuit, is presented with emphasis on design and operational safety aspects. A test program using boron/epoxy and graphite/epoxy material specimens is outlined. Possible applications and modifications for this type of facility are suggested that are commensurate with the future uses of nonmetallic composite materials in aircraft structures. Dissert. Abstr.

N78-17293* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PARTICLE PARAMETER ANALYZING SYSTEM Patent
David O. Hansen (TRW Inc., Redondo Beach, Calif.) and Neal L. Roy, inventors (to NASA) (TRW Inc., Redondo Beach, Calif.) Issued 21 Jan. 1969 5 p Filed 28 Jan. 1966 Sponsored by NASA
(NASA-Case-XLE-06094; US-Patent-3,423,627;
US-Patent-Appl-SN-523632; US-Patent-Class-315-22) Avail: US Patent Office CSCL 09C

An X-Y plotter circuit apparatus is described which displays an input pulse representing particle parameter information, that would ordinarily appear on the screen of an oscilloscope as a rectangular pulse, as a single dot positioned on the screen where the upper right hand corner of the input pulse would have appeared. If another event occurs, and it is desired to display this event, the apparatus is provided to replace the dot with a short horizontal line.
Official Gazette of the U.S. Patent Office

N78-17294* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
TEMPERATURE COMPENSATED CURRENT SOURCE Patent
David Roy Breuer, inventor (to NASA) (TRW, Inc., Redondo Beach, Calif.) Issued 6 Apr. 1971 6 p Filed 16 Jan. 1968 Sponsored by NASA
(NASA-Case-MSC-11235; US-Patent-3,573,504;
US-Patent-Appl-SN-698239; US-Patent-Class-307-270;
US-Patent-Class-307-297; US-Patent-Class-323-4;
US-Patent-Class-328-172) Avail: US Patent Office CSCL 09C

A current source was designed which is substantially independent of variations of temperature. The current source may be made either to have a linear dependence upon changes of temperature or, by the simple addition of a resistor, may be made substantially independent of temperature variations. Since the current source consists only of transistors of one conductivity type and resistors, it is ideally suited for manufacture in the form of a monolithic integrated circuit.
Official Gazette of the U.S. Patent Office

N78-17295* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TRANSFORMER REGULATED SELF-STABILIZING CHOPPER Patent
Frank L. Raposa, inventor (to NASA) (United Aircraft Corp., East Hartford, Conn.) Issued 28 Oct. 1969 4 p Filed 22 Sep. 1967 Sponsored by NASA
(NASA-Case-XGS-09186; US-Patent-3,475,675;
US-Patent-Appl-SN-669911; US-Patent-Class-323-18) Avail: US Patent Office CSCL 09C

A self-stabilizing voltage regulator is described. Direct current voltage regulation employing a series transistor rendered conductive during various portions of a cycle is controlled by saturation of an autotransformer. The constant volt-second capacity of the transformer provides conduction time inverse to the input voltage whereby average output voltage is maintained constant Conduction commensed in response to short gate signals. and resistor feedback for degenerative turn-off of the transistor was after transformer saturation. Standard output filters are also included. Author

N78-17296* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SHUNT REGULATION ELECTRIC POWER SYSTEM Patent
Warren H. Wright (TRW Inc., Redondo Beach, Calif.) and John J. Bless, inventors (to NASA) (TRW Inc., Redondo Beach, Calif.) Issued 17 Aug. 1971 9 p Filed 3 Oct. 1968 Sponsored by NASA
(NASA-Case-GSC-10135; US-Patent-3,600,599;
US-Patent-Appl-SN-764823; US-Patent-Class-307-53;
US-Patent-Class-307-69; US-Patent-Class-320-53;
US-Patent-Class-323-19) Avail: US Patent Office CSCL 09C

A regulated electric power system having load and return bus lines is described. A plurality of solar cells interconnected in a power supplying relationship and having a power shunt tap point electrically spaced from the bus lines is provided. A power

dissipator is connected to the shunt tap point and provides for a controllable dissipation of excess energy supplied by the solar cells. A dissipation driver is coupled to the power dissipator and controls its conductance and dissipation and is also connected to the solar cells in a power taping relationship to derive operating power therefrom. An error signal generator is coupled to the load bus and to a reference signal generator to provide an error output signal which is representative of the difference between the electric parameters existing at the load bus and the reference signal generator. An error amplifier is coupled to the error signal generator and the dissipation driver to provide the driver with controlling signals. Official Gazette of the U.S. Patent Office

N78-17297*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VOLTAGE FEED THROUGH APPARATUS HAVING REDUCED PARTIAL DISCHARGE Patent Application
Stephan R. Peck (GE, Philadelphia) and Jeffrey W. Benham, inventors (to NASA) (GE, Philadelphia) Filed 10 Jan. 1978 15 p
(NASA-Case-GSC-12347-1; US-Patent-Appl-SN-868249) Avail: NTIS HC A02/MF A01 CSCL 09A

Voltage feed through apparatuses where the partial discharge occurrences were reduced to a magnitude of not more than five partial discharge occurrences are illustrated. Voltage feed through apparatuses were used to properly measure partial discharge occurrences by items under test prior to their use in spacecraft and other hostile environments. NASA

N78-17298*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NOISE AS A TOOL FOR EVALUATING THE ACTIVATION OF CATHODES
Henry Kosmahl 1978 6 p Presented at the Space Traveling Wave Tube Cathode Conf., Washington, D. C., 30 Jan. - 1 Feb. 1978; sponsored by DoD and IEEE
(NASA-TM-73895; E-9520) Avail: NTIS HC A02/MF A01 CSCL 09C

Measurements, at low frequencies, of the shot noise current from space charge limited cathodes always produced results substantially in excess of theoretical predictions. Measuring the ratio (I sub eq)/S yielded a relation (I sub eq)/S = 1.288 V sub k = 1.288 k(T sub k)/e, independent of the operating point of the diode (triode) as long as all parts of the cathode had a full space charge controlled emission. This method was so sensitive as to permit detection of cathode temperature changes by 1 K, thus it allowed a powerful screening method between well and poorly activated cathodes, superior to dip tests and other current-voltage methods. Author

N78-17299# Westinghouse Defense and Electronic Systems Center, Baltimore, Md. Systems Development Div.
MNOS BORAM MANUFACTURING METHODS AND TECHNOLOGY PROJECT Quarterly Technical Report, 1 Apr. - 30 Jun. 1977
J. E. Brewer Jul. 1977 40 p
(Contract DAAB07-76-C-0048)
(AD-A047498; Rept-77-0870; QTR-4) Avail: NTIS HC A03/MF A01 CSCL 09/1

A manufacturing methods project has been initiated to establish a pilot production line for metal nitride oxide semiconductor (MNOS) block oriented random access memory (BORAM) multichip hybrid circuits. During the past quarter the integrated circuit due for engineering and confirmatory samples were fabricated. All component parts for engineering samples were procured or fabricated. Hybrid circuit thermal characteristics were examined, and memory transistor performance characteristics were explored. The chip and hybrid circuit manufacturing flow were finalized. Author (GRA)

N78-17300# Raytheon Co., Quincy, Mass. Industrial Components Operation.
MANUFACTURING METHODS AND TECHNOLOGY ENGINEERING (MM AND TE) PROGRAM FOR THE ESTABLISHMENT OF PRODUCTION TECHNIQUES FOR HIGH DENSITY THICK FILM CIRCUITS USED IN CRYSTAL OSCILLATORS Quarterly Progress Report, 22 Nov. 1976 - 27 Feb. 1977
Charles T. Martin 12 Jul. 1977 69 p ref
(Contract DAAB07-76-C-8119)
(AD-A047497; QPR-2) Avail: NTIS HC A04/MF A01 CSCL 09/5

Production techniques are being established for a thick film hybrid microelectronic 17-22 MHz, temperature-compensated, voltage-controlled crystal oscillator. In the engineering phase of this program, the following was accomplished during this quarter: the design of a module extraction feature, the detailed design of module potting shells, the generation of master artwork of the thick film circuit patterns, the continued development of a process for hermetically sealing the hybrid microcircuits using ceramic corrals and flat metal covers, the generation of detailed test flow plans and of preliminary electrical test procedures, the design and fabrication of special tooling and fixturing for hermetic sealing, resistor trimming and electrical testing, the processing of thick film substrates and the start of substrate assembly. Details of this work are reported, and the designs documented. GRA

N78-17301# Physics International Co., San Leandro, Calif.
PULSE TRANSFORMER DESIGN STUDY Final Report, Dec. 1975 - Mar. 1977
Harlin Aslin Ft. Monmouth, N. J. ECOM Nov. 1977 88 p refs
(Contract DAAB07-76-C-1292; DA Proj. 1L7-62705-AH-94) (AD-A047499; PIFR-897; ECOM-76-1292-F) Avail: NTIS HC A05/MF A01 CSCL 09/1

This final report describes the design, development of fabrication techniques, fabrication, and testing of two uniform field, air core pulse transformers. The described transformer design minimizes the volume of dielectric material, which provides turn-to-turn insulation, reduces stray series inductance, and thus improves the transformer high frequency response in comparison to conventional pulse transformers. The described pulse transformers are intended for repetitive pulse operation with output voltages of about 200 kV into matched resistive loads. Output pulse width and risetimes are about 10 microsec and 1 microsec (10 to 90 percent) respectively. Author (GRA)

N78-17302# Naval Research Lab., Washington, D. C.
VOLTAGE-CONTROLLED OSCILLATOR WITH TIME-DELAY FEEDBACK Interim Report
J. B. L. Rao and W. M. Waters 8 Sep. 1977 15 p refs
(ZF12151001)
(AD-A047411; AD-E000031; NRL-8138) Avail: NTIS HC A02/MF A01 CSCL 09/5

A voltage-controlled oscillator with time-delay feedback is analyzed. The results indicate that by properly choosing system parameters, both low noise from the degeneration and frequency agility from the periodic response can be obtained in one source. The conditions for system stability and the amount of noise degeneration are expressed in terms of system parameters. Effects of different parameters on system stability and noise degeneration are discussed in detail. It is shown that the open-loop gain should be chosen as large as possible for good noise degeneration, and the amplifier-filter bandwidth should be chosen to meet the stability condition. Author (GRA)

N78-17303# GenRad, Inc., Concord, Mass.
AUTOMATIC MICROCIRCUIT BRIDGE Final Report, 1 Jun. 1975 - 30 Jun. 1976
William F. Byers, William J. Riley, and Robert A. Soderman Aug. 1976 116 p
(Contract DAAB07-75-C-1341; DA Proj. 1S7-62705-AH-94) (AD-A047929; Rept-6835-0002; ECOM-75-1341-F) Avail: NTIS HC A06/MF A01 CSCL 14/2

This report summarizes the work done on the design, construction and test of an Offset Local Oscillator for use with the Tracking Servobridge Detector as part of a system for precision bridge-type measurements on quartz crystal resonators. The primary requirement for the Offset LO is to accept a generator input signal over the range of 0.8 to 220 MHz and produce an output which is offset from the input frequency by +80 kHz. This output serves as the local oscillator signal for a sensitive heterodyne detector and must be essentially free of a direct generator input component to avoid a spurious receiver response. The design approach used is to first produce a crude offset signal by phasing-type single-sideband techniques and then use

a phase locked oscillator as an active filter to obtain the required spectral purity. The electronic circuits which implement this design are described in detail. The report contains the results of tests made on three Offset LO units. All requirements were met, and a viable design was achieved. The report also contains an analysis of an electronically tunable microcircuit RF bridge suitable for the automatic measurement of quartz crystal parameters. It is concluded that the measuring system studied indeed has the potential of making the desired measurements automatically. Possible sources of errors have been analyzed and corrective solutions proposed. Expected performance is in accordance with the latest guidelines for the system.

Author (GRA)

N78-17304# Harry Diamond Labs., Adelphi, Md.
A LOW-POWER DIGITAL TIMER WITH POTENTIOMETER SETTING MECHANISM
Friedrich W. Flad Oct. 1977 28 p
(DA Proj. 1W3-62616-AH-77)
(AD-A047799; HDL-TM-77-25) Avail: NTIS HC A03/MF A01 CSCL 09/5

A digital electronic timer is described that uses the position of a potentiometer for time selection. Upon activation of a power supply, a counter in the timer is preset to the binary equivalent of the potentiometer setting and then proceeds to time out by counting from the preset state to overflow. The counting rate is determined by the frequency of a crystal controlled oscillator. During the time interval up to and including the preset cycle, the current drain of the circuit is 800 microamp. at 5.5 V. After completion of the preset operation, the current consumption drops to 20 microamp. at the reduced voltage of 3.6 V. This low operating power makes it possible to use this circuitry in a fuze with a fluidic power supply wherein a charged capacitor could bridge a temporary power loss during projectile flight through apogee. Although the system is described with a potentiometer as the input device, the electronic part is not so limited. This preset scheme can be used whenever the digital output from the counter can be converted into a single-valued time-varying function commensurate with a constant or quasi-constant input quantity, which is a function of the desired time delay. GRA

N78-17305# Canadian Commercial Corp., Ottawa (Ontario).
MANUFACTURING METHODS AND TECHNIQUES FOR MINIATURE HIGH VOLTAGE HYBRID MULTIPLIER MODULES Quarterly Report, 1 Jul. - 30 Sep. 1977
Michael Korwin-Pawlowski 8 Nov. 1977 42 p Prepared in cooperation with Erie Technol. Products of Canada, Trenton Ontario
(Contract DAAB07-76-C-0041)
(AD-A047899; QR-5) Avail: NTIS HC A03/MF A01 CSCL 09/5

The progress made during the fifth quarter of work on the Manufacturing and Technology Program for Miniature High Voltage Multiplier Modules is described in this report. The results of electrical performance testing at the room, high (+52 C) and low (-54 C) temperatures as well as effects of thermal shock, and high and low temperature storage are presented.

Author (GRA)

N78-17306# Rockwell International Corp., Richardson, Tex. Hybrid Microelectronics Div.
A PRODUCTION ENGINEERING MEASURE FOR TWO L BAND SOLID STATE MICROWAVE FREQUENCY SOURCES Quarterly Report, 30 Nov. 1976 - 28 Feb. 1977
Jerome K. McCoy 30 Mar. 1977 57 p
(Contract DAAB07-76-C-0026)
(AD-A047902; QR-3) Avail: NTIS HC A04/MF A01 CSCL 09/5

This report describes the specifications and approach, and details the work completed in the design and fabrication of an L Band Radiosonde Modulator/Transmitter and an L band FM Source. Q of microstrip resonators and the ability to screen conductor material through substrate holes are being investigated in the thick film materials evaluation program. Production planning is in progress and plans have been formulated for the fourth set of engineering samples. Author (GRA)

N78-17307# RCA Government and Commercial Systems, Burlington, Mass. Automated Systems Div.
BATTERY CHARGER PP-7286 ( )/U Final Report, Jul. 1976 - Jun. 1977
J. Woodward and S. Waldstein Ft. Monmouth, N. J. ECOM Dec. 1977 89 p
(Contract DAAB07-74-C-0270; DA Proj. 1E7-64723-DL-71)
(AD-A047881; ECOM-74-0270-F) Avail: NTIS HC A05/MF A01 CSCL 09/5

The Battery Charger PP-7286 was developed to support the Laser Rangefinder MX-9838 which is powered by a rechargeable nickel cadmium battery, type BB-516 and other Army equipment using generically similar batteries. The technical characteristics are described in ECOM Development Specification Number EL-CP2128-0001A. The hardware developed consisted of the Battery Charger PP-7286 and its Transit Case CY-7670. The Battery Charger operates from prime power of 115 or 230 V (plus or minus 10%) 47 to 63 Hz ac. It provides five independently adjustable charging circuits, each capable of being set to charge at constant current rates from 15 through 700 milliamperes inclusive. A multiple scale meter can be switched to measure current in each of the five channels. The circuits provide constant current into any load from zero volts (short circuit) to 36 volts. A digital timer common to all circuits can be set in tenths of an hour increments from 0.1 to 19.1 hours. Time remaining in the charging cycle is displayed by an incandescent, seven segment, 3 digit display. An internal primary battery provides nonvolatile memory for the charger in the event of power interruption. A Sixth position on the meter switch allows the voltage of this battery to be measured. Author

N78-17308# Army Electronics Command, Fort Monmouth, N. J. Electronics Technology and Devices Lab.
FERRITE POWER LIMITER FOR RADIO SET AN/GRC-144 Research and Development Technical Report, Jul. 1975 - Jul. 1977
Samuel Dixon, Jr. Oct. 1977 19 p refs
(DA Proj. 1L7-62705-AH-94)
(AD-A047772; ECOM-4541) Avail: NTIS HC A02/MF A01 CSCL 09/5

This investigation describes analytical and experimental results obtained on a C-band ferrite limiter which utilizes a YIG rod inserted along the longitudinal axis of a coupled dielectric resonator bandpass structure. This device is aimed at providing receiver front-end protection for communication systems such as the AN/GRC-144 which operate in a dense, high signal power environment. By utilizing a long, thin, single crystal YIG rod instead of YIG spheres, the limiter dynamic range has been extended from 20 db to 35 db. The threshold power varies from 5 dbm at 4.4 GHz to 15 dbm at 5.0 GHz with an insertion loss of less than 1.0 db across the band. Author (GRA)

N78-17309# Auburn Univ., Ala. Dept. of Physics.
EFFECTS OF EXCESS CHARGE DENSITY ON DIELECTRIC BREAKDOWN IN SOLIDS Ph.D. Thesis. Final Report
Jack M. Lloyd, Jr. and Paul P. Budenstein 10 Nov. 1977 190 p refs
(Grant DAHC04-74-G-0047)
(AD-A048267; ARO-12068.2-RTL) Avail: NTIS HC A09/MF A01 CSCL 20/3

After consideration of the available experimental evidence and an examination of the previously proposed models of electric breakdown in solid dielectrics, it appears that the model (proposed by Budenstein) for the formation of a hot, high pressure gas channel within the dielectric prior to breakdown conduction more nearly describes the conditions occurring during breakdown. This paper considers the formation of a gas within a solid dielectric under high electrical stress. A possible sequence of reactions in alkali halide materials is presented. To provide further perspective on the energetics of bond disruption (gas formation), a calculation of the ground state energy of the doubly negative hydrogen molecular ion is made. This calculation shows that this state is strongly repulsive and the calculation gives a scale of distance for electron interactions with molecular states. The ground state energies of the neutral hydrogen molecule and the He-He system are also calculated with the wavefunction chosen for the doubly negative ion as a check on the accuracy of the energy calculations and for comparison with the doubly negative

ion energy. The results of these calculations are applied to the breakdown problem to show that a localized excess charge density can cause bond disruption under the proper conditions and lead to the formation of a gas within the dielectric. Author (GRA)

N78-17310# Helsinki Univ. of Technology, Espoo (Finland). Radio Lab.

GENERALIZED INTERDIGITAL FILTER MADE OF MULTILAYER STRIPLINES

Kari Jokela 1977 35 p refs
(Rept-S-97; ISBN-951-751-043-8) Avail: NTIS HC A03/MF A01

A relatively simple loss analysis method is presented for many coupled line structures. The corresponding equivalent circuit consists of uncoupled lossy transmission lines the parameters of which are determined relatively easily without a complex numerical field analysis by using fringing capacitance curves for rectangular strips. In the narrowband case further approximations are possible. The increase of accuracy is most significant if the couplings between strips are tight. A realization of the generalized interdigital filter using a multilayer structure consisting of polyphenyleneoxide plates is discussed. The repeatability of the filters is improved with the aid of thin polyethylene films. The shorts are made by the copper coating that also effectively suppresses higher order modes. The fine tuning of the filter can be made by tuning screws. Improving the design accuracy without tuning elements using a computer simulation is also discussed. Finally, the effects of the losses were studied connecting the presented loss analysis with ring resonator measurements. Author (ESA)

N78-17311# Helsinki Univ. of Technology, Espoo (Finland). Radio Lab.

A MILLIMETER WAVELENGTH TRANSFERRED ELECTRON OSCILLATOR

David E. Meharry 1977 35 p
(Rept-S-99; ISBN-951-751-045-4) Avail: NTIS HC A03/MF A01

The design and construction of a transferred electron oscillator for the 26.5 to 40 GHz waveguide band is described in detail. Results are given for one oscillator the 3 db oscillation bandwidth of which is 26.4 to 41.8 GHz, obtained by optimizing both tuning and bias voltage. With fixed tuning and bias voltage the same oscillator gives adequate output power between 26 and 40 GHz, with a 3 db tuning band of 11.5 GHz. The design was scaled to the 18 to 26.5 GHz waveguide band, again demonstrating good, wide band behavior. Author (ESA)

N78-17312# Helsinki Univ. of Technology, Espoo (Finland). Radio Lab.

ASPECTS OF MICROWAVE FIELD EFFECT TRANSISTOR OSCILLATOR DESIGN

David E. Meharry and Martti Valtonen 1977 32 p refs
(Rept-S-100; ISBN-951-751-046-2) Avail: NTIS HC A03/MF A01

The analysis was carried out in common gate and common source configurations. The method is straightforward and includes calculation of output power. Results indicate superior output power and power-oscillation bandwidth product for the common source configuration, while the common gate configuration is capable of higher frequency operation. The design of the oscillator is completed with the synthesis of an appropriate output matching network. Author (ESA)

N78-17313# Helsinki Univ. of Technology, Espoo (Finland). Radio Lab.

TRANSIENT THERMAL MEASUREMENT OF A TRANSFERRED ELECTRON OSCILLATOR

David E. Meharry and Eero Bomanson 1977 8 p ref Submitted for publication
(Rept-S-102; ISBN-951-751-088-8) Avail: NTIS HC A02/MF A01

The temperature dependence of the various operating parameters of a transferred electron oscillator was determined by means of a novel pulse measurement method which eliminates temperature changes in the external circuit. The simple technique should be applicable to other devices which can be operated in a pulsed mode. Author (ESA)

N78-17314# Helsinki Univ. of Technology, Espoo (Finland). Radio Lab.

THE USE OF JOSEPHSON JUNCTIONS AS MIXERS AND PARAMETRIC AMPLIFIERS AT MICROWAVES

Antti Raeisaenen and Pekka Somervuo 1977 37 p refs
(Rept-S-103; ISBN-951-751-089-6) Avail: NTIS HC A03/MF A01

The usefulness of Josephson junctions for high frequency applications such as mixers and parametric amplifiers has been proved in many experiments. Best performance values until now are: noise temperature T sub M = 54 K with a net conversion efficiency (gain) eta = 1.35 for a 36 GHz mixer and noise temperature T sub N = 20 K with a net gain G = 15 db for a 33 GHz parametric amplifier. Both treatments to explain the mixing and amplification phenomena and experiments of Josephson devices for these purposes are reviewed. Author (ESA)

N78-17315# Paul Sabatier Univ., Toulouse (France). Lab. de Genie Electrique.

CORONA DISCHARGE AND AGEING PROCESS OF AN INSULATION

C. Mayoux [1977] 10 p refs Sponsored partly by CNRS, Elec. de France, and Min. de l'Ind. et de la Rech.
Avail: NTIS HC A02/MF A01

Corona discharge was studied taking discharge as a streamer-like process. After having compared the effect of UV radiations and low energy particles like electrons and positive ions by means of an infrared analysis, experiments were carried out with ions lower than 30eV. Though the ions seem to be the more effective particles, their impact did not give so important a degradation as the one due to discharges. An ultraviolet spectroscopy analysis was used to show the presumed increasing conductivity. Future work on the subject is proposed in order to elucidate the surface transformations and the breakdown of insulating materials. Indeed as few results are known on the effect of neutral and negative particles as on the simultaneous aging of the discharge constituents considered two by two. Author (ESA)

N78-17316# Paul Sabatier Univ., Toulouse (France). Lab. de Genie Electrique.

RECENT PROGRESS IN THE STUDY OF CORONA FREQUENCY ANALYSIS DURING THE INSULATION AGING

R. Lacoste and C. Mayoux 1976 7 p refs Presented at the NORDIS 76 Symp. on Elec. Insulation, Swed., 21 Jun. 1976 Sponsored partly by CNRS, Elec. de France, and Min. de l'Ind. et de la Rech.
Avail: NTIS HC A02/MF A01

In studying insulation aging by partial discharges, the technique of frequency analysis (chromograms) was improved. The rise time of the impulses due to the discharges appearing in small gaps was taken into account as the time storage of the pulse height analyzer in respect to the delta t resolution. The first corresponding spectra are presented for two detection ranges. Author (ESA)

N78-17317# Helsinki Univ. of Technology, Espoo (Finland). Radio Lab.

A MECHANICALLY STABLE JOSEPHSON POINT CONTACT MIXER AT 36 GHz

Antti Raeisaenen 1977 27 p refs Sponsored partly by Emil Aaltonen Found. and Finn. Cult. Found.
(Rept-S-95; ISBN-951-750-982-0) Avail: NTIS HC A03/MF A01

In the 36 GHz Josephson point contact mixer described, the junction is located in a waveguide flange construction and can be adjusted and locked at room temperature. The theory of operation and the equivalent RSJ model of the junction are analyzed. The experimental setup is detailed with regard to cryogenics, microwave sources, intermediate frequency system VA characteristic measurement, conversion loss measurement, and noise temperature measurement. The experimental results are discussed with regard to DC properties, conversion loss, noise temperature, and mechanical stability of the mixer. ESA

N78-17318# Technical Research Centre of Finland, Helsinki. Instrument Lab.

AN ELECTRIC CIRCUIT FOR PHOTOMULTIPLIER TO

PERFORM DIVISION DELTA R/R IN OPTICAL MODULATION SPECTROSCOPY
R. Louhenperae and T. Tuomi 1976 10 p refs
(VTT-GD-1; ISBN-951-38-0294-9) Avail: NTIS HC A02/MF A01

An electronic circuit for modulation spectroscopy was built to keep the dc-voltage of the photomultiplier output practically constant at -1V in spite of variations in the incident light intensity. This is performed by the negative feedback of the variations in the dc-voltage to the high voltage of the photomultiplier. The ac-part of the photomultiplier output gives, e.g., when electric field modulation is used, the change of reflectance delta R divided by the reflectance R. As an example a measured electroreflectance spectrum of GaAs near its E1 + Delta 1 transitions is presented. Author (ESA)

N78-17319# Technical Research Centre of Finland, Helsinki. Instrument Lab.
X-RAY TOPOGRAPHIC EXPERIMENTS WITH Si, Ge, ALPHA-S, HMT AND PtCo CRYSTALS AND WITH INTEGRATED CIRCUITS USING SYNCHROTRON RADIATION.
Vaeinoe Kelhae, Kari Naukkarinen (Helsinki Univ. of Technol.), Markku Tilli (Helsinki Univ. of Technol.), Turkka Tuomi, and Jean diPersio (Univ. des Sci. et Tech. de Lille) 1976 20 p refs
(VTT-GD-2; ISBN-951-38-0393-7) Avail: NTIS HC A02/MF A01

The contrast in transmission topographs of a thin Si crystal was studied as a function of bending. Grain boundaries in a polycrystalline silicon slice were topographed with back reflection showing the general structure of the grain boundaries as well as twins. Transmission Laue pattern of a silicon crystal containing a number of integrated circuits revealed oxide edges of circuit, long rectilinear dislocations extending over several integrated circuit units, and dislocation loops between adjacent circuits. The high speed, high resolution topography technique with synchrotron radiation proved to be a valuable method for detecting defects in integrated circuits. Magnetic domains of a polycrystalline PtCo sample were studied by using Kerr and colloid technique as well as by using a new combined magneto-optical-colloid technique, which resulted in the best contrast. The X-ray reflection topograph taken from the same sample as was studied with optical microscopy showed a Laue pattern the spots of which had a similar structure as the optical pictures but in addition, showed that the lattice planes were bent about 2.5 deg.
Author (ESA)

N78-17320# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
A RELATIVELY SHORT CYLINDRICAL BROADBAND ANTENNA WITH TAPERED RESISTIVE LOADING FOR PICOSECOND PULSE MEASUREMENTS
Motohisa Kanda Aug. 1977 47 p refs
(PB-274057/9; NBSIR-77-861) Avail: NTIS HC A03/MF A01 CSCL 09E

A relatively short cylindrical antenna with continuously tapered resistive loading was studied for the purpose of picosecond pulse and extremely broadband CW measurements. The antenna considered is a nonconducting cylinder with continuously deposited, varying conductivity, resistive loading. The current distributions on the antenna were numerically calculated using the method of moments. Using these current distributions, input impedance, near field and far field radiation patterns, and radiation efficiency were also numerically calculated and compared with the results using approximate current distribution. GRA

N78-17321# National Bureau of Standards, Washington, D. C. Center for Building Technology.
EXPLORATORY STUDY OF GLOWING ELECTRICAL CONNECTIONS Final Report
William J. Meese and Robert W. Beausoliel Oct. 1977 31 p refs Sponsored in part by HUD
(PB-273577/7; NBS-BSS-103) Avail: NTIS HC A03/MF A01 CSCL 09A

The extent to which loose electrical connections in residential-type branch circuits have overheated in a laboratory was described and characterized. With loose electrical connections, which conceivably could be inadvertently duplicated in field installations, but with otherwise normal installation and operating conditions, visible glows were observed under laboratory test conditions in normal 120-volt, 15 and 20 ampere branch circuits with both copper and aluminum wire. Characteristics of the glow condition were differentiated from arcing/sparking as sometimes observed in making or breaking electric circuits. Glowing electrical connections may dissipate as much as 35 watts of power with a current of 15 amps in the circuit and as much as 5 watts with a current of 0.8 amps in the circuit. Temperatures over 750 F were measured on the 'break-off tab' of receptacles. GRA

N78-17109*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MULTIPURPOSE ELECTRIC FURNACE: EXPERIMENT MA-010
A. Boese, J. McHugh (Westinghouse Research Labs., Pittsburgh), and R. Seidensticker (Westinghouse Research Labs., Pittsburgh) *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 353-365 (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 09C

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N78-17322 New Jersey Inst. of Technology, Newark.
DYNAMIC ANALYSIS OF STRUCTURES WITH SOLID-FLUID INTERACTION Ph.D. Thesis
Renee Ramona Pedrido 1977 301 p
Avail: Univ. Microfilms Order No. 77-22454

A finite element model for interaction between an elastic solid and a fluid medium was developed. Plane triangular finite elements were used separately for fluid, solid, and solid-fluid continua. The equivalent mass, damping, and stiffness matrices and interaction load arrays for all elements were derived and assembled into global matrices. The global matrix differential equation of motion developed was solved in time to obtain the pressure and velocity distributions in the fluid, as well as the displacements in the solid. Two independent computer programs, each employing different algorithms and numerical solution techniques, were used to obtain the dynamic solution. The first program is FLINTS (fluid interacting with solid), a special purpose finite element program developed for solid-fluid interaction studies. The second program is WECAN (Westinghouse Electric Computer Analysis), a general purpose finite element program in which new element library subroutines for solid-fluid interaction were incorporated. Dissert. Abstr.

N78-17323 Syracuse Univ., N. Y.
ACOUSTIC AND FLOW CHARACTERISTICS OF COLD HIGH SPEED COAXIAL JETS Ph.D. Thesis
Mohamed Reada Bassiouni 1976 201 p
Avail: Univ. Microfilms Order No. 77-24354

The potential of using the coaxial supersonic interacting jets as a jet noise suppression technique was investigated. Extensive experimental investigations of far field noise from model supersonic coaxial cold jets were conducted. These experiments were performed for two and three nozzle arrangements and single convergent underexpanded round and annular jets at a wide range of operating pressure ratios (from pressure ratio 2.63 to 5.12). All nozzles have equal exit area, coplanar exits and finite but thin nozzle lips. Comparison schemes are presented for the overall acoustic power levels produced by coaxial multiple nozzles operated at minimum noise mode of operation. Dissert. Abstr.

N78-17324 California Univ., Davis.
A NUMERICAL MODELING OF THE FLUID DYNAMIC STABILITY OF HAGEN-POISEUILLE FLOW Ph.D. Thesis
Demos Theodore Kyrazis 1977 195 p
Avail: Univ. Microfilms Order No. 77-27387

The theory of fluid dynamic stability was applied to types of flows and correct results obtained. However, when the stability

of Hagen-Poiseuille flow in a pipe was examined, the results always showed the flow to be stable for all Reynolds numbers. Yet experiments showed pipe flow to be turbulent above a critical Reynolds number. Experimental results were reproduced, and the numerical model was then used to further explore the characteristics of the pipe flow. The following new conclusions were stated as a result of this exploration. For fully developed Hagen-Poiseuille flow: (1) a large disturbance was stable and propagated downstream as if it were an infinitesimal disturbance; (2) the time dependent behavior of the eigenfunction was not as would be expected from stability theory; and (3) an unstable solution was shown to exist. Dissert. Abstr.

N78-17325 Stanford Univ., Calif.
GRID-INSENSITIVE COMPUTER SIMULATION OF THE KELVIN-HELMHOLTZ INSTABILITY AND SHEAR FLOW TURBULENCE Ph.D. Thesis
Sang Samuel Wang 1977 218 p
Avail: Univ. Microfilms Order No. 77-25742

Each two-dimensional plasma particle or fluid vortex of Gaussian-shaped charge or vorticity distribution was advanced in an exact, self-consistent force field at every time step. Subgrid accuracy was achieved through cubic spline interpolation. Ten systems were systematically investigated. In each system, the motion of 32,768 particles or vortices were traced through 160 time steps. The linear growth rates of the unstable normal modes agreed satisfactorily with the linear theory. The energy variation of each dominant mode, demonstrated saturation and nonlinear oscillation phenomena. The time development of the unstable systems was displayed by constant charge density or constant vorticity lines and by potential contours or streamlines. Vortexed turbulence or quasi-ordered structures were formed in unstable systems with initial velocity shears. Dissert. Abstr.

N78-17326 Minnesota Univ., Minneapolis.
STUDIES IN THE SLOW FLOWS OF VISCOELASTIC FLUIDS Ph.D. Thesis
Leroy Donald Sturges 1977 281 p
Avail: Univ. Microfilms Order No. 77-26163

Particular problems studied were: the free surface on a simple fluid flowing down a tilted trough; secondary flow induced by rotating an axisymmetric rod of variable cross section around its axis of symmetry; the free surface on a simple fluid filling a trench heated from its side; flow in a rectangular cavity; the shape of the free surface on a viscoelastic jet of fluid; and the free surface on a simple fluid between oscillating planes. The use of perturbation methods leads to fourth order (biharmonic type) problems which arise often in elasticity as well as in Stokes flows in cavities. These problems were solved in terms of a Fourier series of biorthogonal eigenfunctions for finite domains and a variety of boundary conditions. Convergence of the series was studied in detail. Dissert. Abstr.

N78-17327 Illinois Univ., Urbana-Champaign.
THE EFFECT OF A CONCURRENT GAS FLOW ON GAS-LIQUID MASS TRANSFER Ph.D. Thesis
William Howard Henstock 1977 219 p
Avail: Univ. Microfilms Order No. 77-26677

A theory for the mass transfer process was developed. It was assumed that the largest convective motions in the flow control the rate of mass transfer. Measurements of mass transfer coefficients for the absorption of oxygen by water films were made for concurrent flows in a horizontal rectangular channel, and for concurrent and free-falling downflow in a one-inch pipe. The measured values of the Sherwood number for concurrent flows were up to three times as great as would be predicted from this relation. This increase in Sherwood number was correlated with a dimensionless group similar to a Martinelli parameter which is characteristic of two phase flows. An explanation for this effect is given in terms of the way that the scales of the convective motions are related to bulk flow parameters. Dissert. Abstr.

N78-17328 Oregon State Univ., Corvallis.
AN ANALYTICAL MODEL OF HEAT TRANSFER TO A HORIZONTAL CYLINDER IMMERSED IN A GAS FLUIDIZED BED Ph.D. Thesis
Ronald Lynn Adams 1977 196 p
Avail: Univ. Microfilms Order No. 77-25901

A steady gas convection model of heat transfer to a horizontal cylinder immersed in a gas fluidized bed is presented. Contributions due to flow within attached bubbles as well as the interstitial voids were included. The interstitial flow was approximated as flow within a series of double cusped channels and the resulting three dimensional boundary layer flow was analyzed using a Stokes approximation for the corner flow which is simply matched to a two dimensional integral analysis of the central region. Effects of interstitial turbulence were included. Radiation heat transfer from the hot particle surfaces was reviewed so that results at combustion temperatures can be obtained. A computer program was developed and used to obtain results for the case of a horizontal cylinder immersed in a bubbling two dimensional atmospheric pressure bed. The interstitial gas flow for this case was obtained using complex analysis to determine the pressure field near the cylinder with bubbles present. Dissert. Abstr.

N78-17329 Kansas State Univ., Manhattan.
A THERMOREGULATORY MODEL FOR HEAT ACCLIMATION AND SOME OF ITS APPLICATIONS Ph.D. Thesis
Sungnan Hsu 1977 283 p
Avail. Univ. Microfilms Order No. 77-26040

A two-node thermoregulatory model for unacclimated man was developed. Its development was based on the introduction of control functions of skin conductance, sweat rate, and metabolic heat production by shivering based on the most recent experimental physiological information. In the model the effects of salt accumulation on the skin, and sweat decline due to prolonged exposure on thermal regulation were considered. The model for the unacclimated man was used as a basis for developing a thermoregulatory model for acclimated man. This was achieved by incorporating in the model the physiological adjustments which occur during the acclimation process. These were circulatory, metabolic, and most of all sweating adjustment. The model can account for the physiological adjustments which take place each day during the acclimation process. Dissert. Abstr.

N78-17330 Illinois Univ., Urbana-Champaign.
BUOYANT SURFACE JETS DISCHARGED INTO A STRONG CROSSFLOW Ph.D. Thesis
Chi-Yu Lin 1977 245 p
Avail: Univ. Microfilms Order No. 77-26701

Analytical and experimental investigations were carried out for three dimensional buoyant surface jets discharged into a strong ambient flow where spatially dependent velocity and temperature fields may exist. A numerical model was developed based on an integral jet analysis modified for buoyancy effects. The present model was developed in curvilinear coordinate to account for rapid curvature of the jet trajectory, and included unequal lateral spreading on the two sides of the jet and asymmetry of velocity and temperature profiles in the jet. To obtain a closed system of equations, the jet spreading concept was employed. Dissert. Abstr.

N78-17331 Mississippi State Univ., State College.
NUMERICAL SOLUTION OF INCOMPRESSIBLE NAVIER-STOKES EQUATIONS IN INTEGRO-DIFFERENTIAL FORMULATION USING BOUNDARY-FITTED COORDINATE SYSTEM Ph.D. Thesis
Rama Narayana Reddy 1977 251 p
Avail: Univ. Microfilms Order No. 77-28563

Numerical solution of the two dimensional, incompressible, time-dependent Navier-Stokes equations in integro-differential formulation was investigated. Numerical computations were confined to the region of significant vorticity, but the solution was obtained in the entire field. The numerically-generated boundary-fitted curvilinear coordinate system was used to keep a coordinate line coincident with the expanding boundary of the region of significant vorticity. However, all the computations were performed on a rectangular, transformed plane with a constant square mesh having a fixed number of grid points. The time-dependent coordinate system was used to accomplish the coordinate system changes between time steps. The coordinate system control was used to obtain the required mesh size near the body. Dissert. Abstr.

N78-17332 Purdue Univ., Lafayette, Ind.
TURBULENCE AND MASS TRANSFER (GAS ABSORPTION) FOR FLOW IN A ROTATING, ANNULAR, OPEN CHANNEL WITH A STATIONARY BOTTOM Ph.D. Thesis
Larry Keith Brumfield 1977 414 p
Avail: Univ. Microfilms Order No. 77-30061

Both the turbulence and the mass transfer characteristics were studied for water flow in a rotating, annular, open channel with a stationary, smooth bottom. The purpose of the study was to provide information concerning the mass transfer mechanism at the free, gas-liquid interface. The test chamber consisted of two concentric, corotating cylinders with diameters of 11.56 in. and 6.96 in. Hot-film anemometry was used to measure turbulence intensity and length. The predictive capabilities of various mass transfer models were assessed by employing the measured turbulence-property distributions in various model equations. Models based on a consideration of the local turbulence structure were found superior to models based on a direct consideration of bulk-flow characteristics. Dissert. Abstr.

N78-17333 Washington Univ., St. Louis, Mo.
NON-NEWTONIAN SUSPENSION BEHAVIOR DUE TO FLOW DISTURBANCE INERTIAL EFFECTS Ph.D. Thesis
Cesar Alberto Garcia-Franco 1977 125 p
Avail: Univ. Microfilms Order No. 77-28341

A theoretical study of a dilute and neutrally buoyant suspension of rigid spheres within an incompressible Newtonian fluid is presented. It is shown that the kinetic energy of the flow disturbance, arising from the presence of the spheres, and the sphere's rotational motion are mechanisms for storing energy and causing memory effects which give rise to phenomena similar to those found in viscoelastic fluids. An analytical expression for the Weissenberg number is provided in terms of the dimensions of the inclusions and their volume fraction, the fluid characteristics, and the rate of the flow field. Such an expression is used to predict the size of the spherical inclusions for cases in which the normal stresses are comparable to the shear stress.
Dissert. Abstr.

N78-17334 Tennessee Technological Univ., Cookeville.
BOUNDARY-LAYER FLOWS OF VISCOELASTIC FLUIDS Ph.D. Thesis
Steve G. Rochelle 1977 162 p
Avail: Univ. Microfilms Order No. 77-28288

Several problems on boundary layer flows of viscoelastic fluids are discussed. A constitutive equation of the nonlinear Maxwell type was chosen to study steady and unsteady flows past infinitely and semi-infinitely long flat plates and steady flows past wedges and parabolas and past circular cones paraboloids. The quasi-linearized boundary layer form of the governing equations were solved numerically and presented graphically to illustrate properties of viscoelastic boundary-layer flows.
Dissert. Abstr.

N78-17335* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MAGNETIC HEAT PUMPING Patent
Gerald V. Brown, inventor (to NASA) Issued 17 Jan. 1978 9 p Filed 30 Nov. 1976 Supersedes N77-15343 (15 - 06, p 0750)
(NASA-Case-LEW-12508-1; US-Patent-4,069,028; US-Patent-Appl-SN-746580; US-Patent-Class-62-3) Avail: US Patent Office CSCL 20D

A ferromagnetic or ferrimagnetic element is used to control the temperature and applied magnetic field of the element to cause the state of the element as represented on a temperature-magnetic entropy diagram to repeatedly traverse a loop. The loop may have a first portion of concurrent substantially isothermal or constant temperature and increasing applied magnetic field, a second portion of lowering temperature and constant applied magnetic field, a third portion of isothermal and decreasing applied magnetic field, and a fourth portion of increasing temperature and constant applied magnetic field. Other loops may be four-sided, with two isotherms and two adiabats. Preferably, a regenerator is used to enhance desired cooling or heating effects, with varied magnetic fields, or varying temperatures including three-sided figures traversed by the representative point.
Official Gazette of the U.S. Patent Office

N78-17336* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HEAT PIPE WITH DUAL WORKING FLUIDS Patent
Arnold P. Shlosinger, inventor (to NASA) (TRW Inc., Redondo Beach, Calif.) Issued 11 Dec. 1973 6 p Filed 1 Jun. 1970 Sponsored by NASA
(NASA-Case-ARC-10198; US-Patent-3,777,811; US-Patent-Appl-SN-42088; US-Patent-Class-165-105; US-Patent-Class-165-134) Avail: US Patent Office CSCL 20D

A heat pipe design is offered that utilizes an auxiliary working fluid. The fluid, although being less efficient than the main working fluid, remains liquid at low heat loads when the main working fluid freezes. Official Gazette of the U.S. Patent Office

N78-17337* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MULTI-CHAMBER CONTROLLABLE HEAT PIPE Patent
Arnold P. Shlosinger, inventor (to NASA) (TRW Inc., Redondo Beach, Calif.) Issued 1 Dec. 1970 8 p Filed 14 May 1969 Sponsored by NASA
(NASA-Case-ARC-10199; US-Patent-3,543,839; US-Patent-Appl-SN-824628; US-Patent-Class-165-32; US-Patent-Class-2-2.1; US-Patent-Class-165-96; US-Patent-Class-165-105) Avail: US Patent Office CSCL 20D

A temperature controllable heat pipe switching device is reported. It includes separate evaporating and condensing chambers interconnected by separate vapor flow and liquid return conduits. The vapor flow conduit can be opened or closed to the flow of vapor, whereas the liquid return conduit blocks vapor flow at all times. When the vapor flow path is open, the device has high thermal conductivity, and when the vapor flow path is blocked the device has low thermal conductivity.
Official Gazette of the U.S. Patent Office

N78-17338*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD FOR CALCULATING CONVECTIVE HEAT-TRANSFER COEFFICIENTS OVER TURBINE VANE SURFACES
Daniel J. Gauntner and James Sucec Jan. 1978 18 p refs
(NASA-TP-1134; E-9324) Avail: NTIS HC A02/MF A01 CSCL 20D

A method for calculating laminar, transitional, and turbulent convective heat-transfer coefficients for turbine vane surfaces is described. An approximate integral solution method produced results in good agreement with a finite-difference solution. Comparisons between the two are presented. The integral solution results agreed well with the finite-difference solution results in the laminar and turbulent regions. Differences in calculating the start of transition produced a later starting point for the approximate integral solution's transitional flow regime. Author

N78-17339*# McDonnell Aircraft Co., St. Louis, Mo.
EVALUATION OF A LARGE CAPACITY HEAT PUMP CONCEPT FOR ACTIVE COOLING OF HYPERSONIC AIRCRAFT STRUCTURE
L. L. Pagel and R. L. Herring Feb. 1978 47 p refs
(Contract NAS1-14981)
(NASA-CR-145301) Avail: NTIS HC A03/MF A01 CSCL 20D

Results of engineering analyses assessing the conceptual feasibility of a large capacity heat pump for enhancing active cooling of hypersonic aircraft structure are presented. A unique heat pump arrangement which permits cooling the structure of a Mach 6 transport to aluminum temperatures without the aid of thermal shielding is described. The selected concept is compatible with the use of conventional refrigerants, with Freon R-11 selected as the preferred refrigerant. Condenser temperatures were limited to levels compatible with the use of conventional refrigerants by incorporating a unique multipass condenser design, which extracts mechanical energy from the hydrogen fuel, prior to each subsequent pass through the condenser. Results show that it is technically feasible to use a large capacity heat pump in lieu of external shielding. Additional analyses are required to optimally apply this concept. Author

N78-17340*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH TEMPERATURE SURFACE PROTECTION
Stanley R. Levine 1978 17 p refs Presented at Spring Review Conf. of the Inst. of Metallurgists, Cardiff, Wales, 7-10 Apr. 1978
(NASA-TM-73877; E-9477) Avail: NTIS HC A02/MF A01 CSCL 20D

Alloys of the MCrAlX type are the basis for high temperature surface protection systems in gas turbines. M can be one or more of Ni, Co, or Fe and X denotes a reactive metal added to enhance oxide scale adherence. The selection and formation as well as the oxidation, hot corrosion and thermal fatigue performance of MCrAlX coatings are discussed. Coatings covered range from simple aluminides formed by pack cementation to the more advanced physical vapor deposition overlay coatings and developmental plasma spray deposited thermal barrier coatings. Author

N78-17341*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ACCELERATED LIFE TESTS OF SPECIMEN HEAT PIPE FROM COMMUNICATION TECHNOLOGY SATELLITE (CTS) PROJECT
Leonard K. Tower and Warner B. Kaufman Dec. 1977 27 p refs
(NASA-TM-73846; E-9433) Avail: NTIS HC A03/MF A01 CSCL 20D

A gas-loaded variable conductance heat pipe of stainless steel with methanol working fluid identical to one now on the CTS satellite was life tested in the laboratory at accelerated conditions for 14,200 hours, equivalent to about 70,000 hours at flight conditions. The noncondensible gas inventory increased about 20 percent over the original charge. The observed gas increase is estimated to increase operating temperature by about 2.2 C, insufficient to harm the electronic gear cooled by the heat pipes in the satellite. Tests of maximum heat input against evaporator elevation agree well with the manufacturer's predictions. Author

N78-17342*# Aerojet Liquid Rocket Co., Sacramento, Calif.
SUPERCRITICAL OXYGEN HEAT TRANSFER Final Report
R. G. Spencer and D. C. Rousar Nov. 1977 95 p refs
(Contract NAS3-20384)
(NASA-CR-135339) Avail: NTIS HC A05/MF A01 CSCL 20D

Heat transfer to supercritical oxygen was experimentally measured in electrical heated tubes. Experimental data were obtained for pressures ranging from 17 to 34.5 MPa (2460 to 5000 psia), and heat fluxes from 2 to 90 million w/sq cm (1.2 to 55 Btu/(sq in. sec)). Bulk temperatures ranged from 96 to 217 K (173 to 391 R). Experimental data obtained by other investigators were added to this to increase the range of pressure down to 2 MPa (290 psia) and increase the range of bulk temperature up to 566 K (1019 R). From this compilation of experimental data a correlating equation was developed which predicts over 95% of the experimental data within + or - 30%. Author

N78-17343*# New York Univ., N. Y. Courant Mathematics and Computing Lab.
A WELL POSED BOUNDARY VALUE PROBLEM IN TRANSONIC GAS DYNAMICS
Jose M. Sanz Feb. 1978 48 p refs
(Grants NGR-33-016-167; NGR-33-016-201; Contract EY-76-C-02-3077)
(NASA-CR-155925; COO-3077-149) Avail: NTIS HC A03/MF A01 CSCL 20D

A boundary value problem for the Tricomi equation was studied in connection with transonic gas dynamics. The transformed equation delta u plus 1/3Y u sub Y equals 0 in canonical coordinates was considered in the complex domain of two independent complex variables. A boundary value problem was then set by prescribing the real part of the solution on the boundary of the real unit circle. The Dirichlet problem in the upper unit semicircle with vanishing values of the solution at Y = 0 was solved explicitly in terms of the hypergeometric function for the more general Euler-Poisson-Darboux equation. An explicit representation of the solution was also given for a mixed Dirichlet and Neumann problem for the same equation and domain. Author

N78-17344# RAND Corp., Santa Monica, Calif.
THE LEVELS OF UNSTEADY POTENTIAL FLOW ON HEATED LAMINAR BOUNDARY LAYERS IN WATER: FLOW PROPERTIES AND STABILITY Interim Report
W. S. King, J. Aroesty, L. S. Yao, and W. Matyskiela Nov. 1977 36 p refs
(Contract DAHC15-73-C-0181)
(AD-A047711; RAND/R-2164-ARPA) Avail: NTIS HC A03/MF A01 CSCL 20/4

The effects of unsteadiness and the stability of boundary-layer flows as governed by the Orr-Sommerfeld equation are discussed. The condition required for validity of the quasisteady approximation of governing flow equations is that the ratio of diffusion time to flow time should be small. It is also shown that criteria for validity of the quasi-steady approximation of the Orr-Sommerfeld equation are based on modifications of this ratio, and are not nearly as stringent. Examples of heated wedge flows in water that are presented and discussed show the profound effect of even slowly varying unsteadiness on both laminar boundary-layer flow and its stability. Author (GRA)

N78-17345# Douglas Aircraft Co., Inc., Long Beach, Calif.
USERS MANUAL FOR A FULLY AUTOMATIC THREE-DIMENSIONAL POTENTIAL-FLOW CALCULATION METHOD. PART 1: WITH VISCOUS CORRECTION BY TWO-DIMENSIONAL BOUNDARY-LAYER ANALYSIS Final Report, Oct. 1973 - Mar. 1977
Dun-Pok Mack and Suzanne M. Schimke 1 Aug. 1977 186 p refs 2 Vol.
(Contract N00014-74-C-0059; SR0230101)
(AD-A047438; MDC-J7644/01-Pt-1) Avail: NTIS MF A01 CSCL 20/4

This report describes a computer program which calculates the viscous effects on the lift and pressure distributions of arbitrary three-dimensional bodies. The program is a combination of a panel method which computes the potential flow about arbitrary three-dimensional lifting configurations, and a two-dimensional boundary-layer method, which calculates the viscous-effects. These effects are applied to the three-dimensional shape in a 'strip-theory' sense and the resultant viscous lift and pressure distributions are produced. Two methods of simulating the boundary layer in the final potential-flow calculation are available: (1) addition of the displacement thickness to the original shape, and (2) defining a surface blowing distribution on the body. The computer program is written in FORTRAN IV for the IBM 370 systems. 16 temporary external units are used for storage. The region size needed to execute the program is about 360K bytes, but this is a direct function of the number of elements defining the configuration. GRA

N78-17346# Douglas Aircraft Co., Inc., Long Beach, Calif.
USERS MANUAL FOR A FULLY AUTOMATIC THREE-DIMENSIONAL POTENTIAL-FLOW CALCULATION METHOD. PART 2: WITH VISCOUS CORRECTION BY SMALL CROSSFLOW BOUNDARY-LAYER ANALYSIS Final Report, Oct. 1973 - Mar. 1977
Dun-Pok Mack 1 Aug. 1977 89 p refs 2 Vol.
(Contract N00014-74-C-0059; SR0230101)
(AD-A047439; MDC-J7644/02-Pt-2) Avail: NTIS HC A05/MF A01 CSCL 20/4

This report describes a computer program which calculates three-dimensional viscous effects on the lift and pressure distributions of arbitrary three-dimensional bodies. The program is a combination of a panel method, which computes the potential flow about arbitrary three-dimensional lifting configurations, and a three-dimensional boundary-layer method, which calculates the viscous effects with small crossflow. These effects are applied to the three-dimensional shape, as in Part 1, in a 'strip-theory' sense and the resultant viscous lift and pressure distributions are again produced. The method of simulating the boundary layer in the final potential-flow calculation is by the addition of the displacement thickness to the original shape. The computer program is written in FORTRAN IV for the IBM 370 systems. 16 temporary external units are used for storage. The region

size needed to execute the program is about 360K bytes, but this is a direct function of the number of elements defining the configuration. GRA

N78-17347# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE SMALL-SIGNAL RESPONSE OF FLUID TRANSMISSION LINES INCLUDING DEVELOPED MEAN FLOW EFFECTS Ph.D. Thesis. Final Report
Ernest Frank Moore Nov. 1977 192 p refs
(AD-A047763; AFIT/Ds/AA/77D-1) Avail: NTIS MF A01 CSCL 20/4

Mathematical models of fluid transmission lines of arbitrary cross section were developed to describe the propagation of small signals through developed mean flow. The mean flow may be either laminar or turbulent and the fluid, either compressible or incompressible. Expressions for both the frequency and time domain dynamic responses are derived. A characteristic radius is defined for any line of arbitrary cross sections, which essentially defines an equivalent circular line having the same dynamic response. The characteristic radius used in dynamic analysis is roughly analogous to the hydraulic radius used in steady flow analysis. In developing the models, the frequency response of annular transmission lines was solved and compared to existing solutions for circular and rectangular lines. Next, the frequency and time domain solutions applicable to arbitrary lines carrying laminar mean flow were obtained in terms of equivalent circular lines. Finally, the concept of a characteristic radius was extended to arbitrary fluid lines carrying turbulent mean flow. The results are shown to be relatively very easy to apply, yet comparable in accuracy to existing, very complex models. The new models should be of significant value to the practicing engineer in fluid systems design and analysis. Author (GRA)

N78-17348# Aeronautical Research Inst. of Sweden, Stockholm.
A MASS-FLOW PROBE FOR MEASUREMENT IN HIGH-ENTHALPY SUPERSONIC BOUNDARY LAYERS
Gunnar Hovstadius Mar. 1977 33 p refs
(AD-A042317; FFA-128) Avail: NTIS HC A03/MF A01 CSCL 14/2

A system for mass flow measurement in supersonic boundary layers has been examined. The mass flow is evaluated from measurements of pressure derivatives in a closed volume under controlled temperature conditions. Measurements of boundary layer properties have been made with the probe side by side with the AVA combined pressure-temperature probe in the FFA Hyp 500 wind tunnel. The mass flows measured with the new system were compared with the mass flows calculated from measurements of stagnation temperature and stagnation pressure with the AVA probe. The results agree within the expected limit of accuracy. Author (GRA)

N78-17349# Aeronautical Research Inst. of Sweden, Stockholm.
FLOW DISTURBANCES ASSOCIATED WITH PRESTON TUBES IN TURBULENT BOUNDARY LAYERS
Arild Bertelrud Jan. 1977 63 p refs
(AD-A042316; FFA-127) Avail: NTIS HC A04/MF A01 CSCL 20/4

An investigation has been made concerning the disturbances from a surface cylinder aligned with the flow in turbulent boundary layers. The object is to study the flow around Preston tubes. Mean velocities and rms-values of the fluctuations were obtained in the centre plane of the cylinder when immersed in turbulent pipe flow. A rough estimate of the drag due to the surface cylinder was also obtained in this case. The pressure distribution near the cylinder was measured in a flat plate boundary layer, and flow visualizations were made with the oil flow technique. In addition, smoke pictures were obtained of the flow for the cases when the boundary layer thickness on the plate was negligible compared to the tube diameter. The present results are of interest in connection with the use of Preston tubes, in particular with regard to the measurement of static pressure. Author (GRA)

N78-17350# Aeronautical Research Inst. of Sweden, Stockholm.
A COMBINED PROBE FOR MEASUREMENT OF MASS FLOW, STAGNATION TEMPERATURE, AND STAGNATION PRESSURE IN SUPERSONIC BOUNDARY LAYERS
Gunnar Hovstadius Mar. 1977 31 p In SWEDISH
(AD-A042318; FFA-129) Avail: NTIS HC A03/MF A01 CSCL 14/2

A combined probe for measurement of mass flow, stagnation temperature, and stagnation pressure in supersonic boundary layers has been built and tested. The mass flow is evaluated from the rate of change of pressure in a volume connected to the probe. The probe incorporates a thermocouple and provision is made for the establishment of a controlled mass flow past the thermocouple during the temperature measurements. The probe has been tested at different pressures and temperatures in the boundary layer on the nozzle wall of the FFA Hyp 500 facilities. The results were compared with the results from simultaneous measurements with the AVA combined pressure-temperature probe. The results agreed within the expected limits of accuracy. Author (GRA)

N78-17351# Naval Research Lab., Washington, D. C.
THE REFRACTION OF A PLANE SHOCK WAVE AT AIR-WATER INTERFACE Interim Report
Richard A. Skop and J. Gordon Showalter Oct. 1977 16 p refs
(AD-A047820; AD-E000066; NRL-MR-3628) Avail: NTIS HC A02/MF A01 CSCL 20/1

The normal refraction at an air water interface of a plane shock wave incident through the air is considered. The perfect gas and Tait equations of state are used, respectively, to represent the thermodynamic properties of the air and water. For refracted pressures up to 1200 atmospheres, the calculations reveal that the in-water shock front and particle velocities and the changes in density differ by less than 10% from the in-water shock front and particle velocities and the changes in density predicted by acoustic theory. The calculations also show that, for a given incident shock, the ratio of the refracted pressure to the pressure reflected from a rigid wall remains above 96% for reflected pressures up to 1200 atmospheres. Author (GRA)

N78-17352# Pennsylvania State Univ., University Park. Applied Research Lab.
TURBULENCE LEVELS AND WAKE DIMENSIONS BEHIND A TOWED BODY
W. R. Hall and S. Hassid 19 Sep. 1977 26 p refs
(Contract N00017-73-C-1418)
(AD-A048038; TM-77-260) Avail: NTIS HC A03/MF A01 CSCL 13/10

Estimates of the turbulence intensity, its persistence and wake dimensions behind a towed body-of-revolution are presented. Contributors to this turbulence include the drag of the body and its towing strut as well as lift generated by the strut due to any misalignment with the tow direction and secondary vortices from the strut/sting intersection. Indications are that if turbulence resulting from body drag were the only consideration, the turbulence would decay to less than 0.10 percent within the time required to return the carriage to the starting point for another run. Calculations that include the drag of the strut show that the waiting time between test runs lengthens slightly. Consideration of disturbances arising from a one degree misalignment of the towing strut results in disturbances of the same order to magnitude as those arising from the drag of the body. Disturbances arising from the secondary vortices have been found to be negligible. An RMS total of all disturbances indicate that a 2-3 minute wait between test runs should be adequate to insure a turbulence level of less than 0.1 percent in the towing basin. Author (GRA)

N78-17353# Institut Franco-Allemand de Recherches, St. Louis (France).
MASS SPECTROMETRIC INVESTIGATION OF EXPLOSIVE GAS BLAST
F. Aulinger and A. Hoeh 18 Feb. 1977 13 p refs Presented at the 7th Intern. Mass Spectrometry Conf., Florence, 30 Aug. - 3 Sep. 1976
(ISL-CO-201/77) Avail: NTIS HC A02/MF A01

The gas blast of secondary explosives detonating in high vacuum shows mean front velocities of the expanding gas cloud of up to 20 km/s. The measuring methods used, however, allowed neither identification of individual chemical components with the clouds nor measurement of inherent speeds. Therefore, a modified

quadrupole mass spectrometer was coupled to a differentially pumped vacuum system, in which the detonation occurs, for dynamic sampling of the gaseous species. Work started with the simple primary explosives lead azide Pb(N3)2, the decomposition products of which are lead and nitrogen. With the main component N2 of the gas blast, a systematic experimental study resulted in time resolved signal curves as the basis for calculating velocity distributions of the molecules. Author (ESA)

N78-17354# Institut Franco-Allemand de Recherches, St. Louis (France).
THE EFFECT OF METAL ADDITIVES ON PRESSURE AND IMPULSE OF THE AIR SHOCK WAVE CAUSED BY DETONATING EXPLOSIVES [DER EINFLUSS VON METALLZUSAETZEN AUF DRUCK UND IMPULS DER VON DETONIERENDEN SPRENGLADUNGEN AUSGEHENDEN LUFTSTOSSWELLE]
H. H. Licht, M. Froboese, G. Mathieu, and E. Burde 3 Jun. 1976 38 p refs In GERMAN Original contains color illustrations
(ISL-R-103/76) Avail: NTIS HC A03/MF A01

The shock waves produced in the atmosphere by explosions with additives of various type and quantity were investigated. Pressure profiles of nonconfined charges were recorded at different distances. It was found that for the additives, which by reaction with detonation products should theoretically increase the energy, aluminum and zirconium had a positive effect, while others, such as boron, reacted too slowly to augment the shock wave intensity. Addition of aluminum (32 weight-%) increases the show wave pressure by about 15% and the impulse by about 30%, in comparison with the pure explosive. ESA

N78-17355# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
ON THE LATTICE HEAT CONDUCTIVITY
A. S. Okhotin 1977 21 p refs
(PR-317) Avail: NTIS HC A02/MF A01

Phonon heat conductivity is determined using the Debye theory. The equation that has been defined for the mean relaxation time in case of long longitudinal acoustic waves based on the assumption that relaxation time in the system from two oscillators obeys the dependence Theta = b/T. It is shown that b is a constant approximately equal to 1.2 x 10 to the minus 12th power sec. x deg. In the Debye formula the final value of heat conductivity is determined by a function taking into account the finite size of a crystal f(T). The values of f(T) were calculated based on temperature and content of impurities using the experimental values of heat conductivity for some materials. Author (ESA)

N78-17110*# Oak Ridge National Lab., Tenn.
SURFACE-TENSION-INDUCED CONVECTION: EXPERIMENT MA-041
R. E. Reed, W. Uelhoff (Institut fuer Festkoerperforschung, Kernforschungsanlage Juelich, West Germany), and H. L. Adair *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 367-401 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 20D

N78-17234 United Kingdom Atomic Energy Authority, Risley (England).
ACOUSTIC VIBRATION OF STRUCTURES IN LIQUIDS
D. Firth *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 9, No. 9 Sep. 1977 p 3-7 refs (For availability see N78-17233 08-31)
Avail: Naval Research Laboratory, Washington, D. C. 20375 SVIC, Code 8404 Annual Rate $40.00 CSCL 20K

N78-17235 Illinois Univ. at Chicago Circle, Chicago.
SOME TRANSIENT PROBLEMS OF STRUCTURES INTERACTING WITH FLUID
Dusan Krajcinovic *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 9, No. 9 Sep. 1977 p 9-16 refs (For availability see N78-17233 08-31)
Avail: Naval Research Laboratory, Washington, D. C. 20375 SVIC, Code 8404 Annual Rate $40.00 CSCL 20K

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N78-17356 Michigan Univ., Ann Arbor.
HOLOGRAPHIC INTERFEROMETRY OF THREE-DIMENSIONAL TEMPERATURE OR DENSITY FIELDS Ph.D. Thesis
Predrag Todor Radulovic 1977 268 p
Avail: Univ. Microfilms Order No. 77-26340

Experimental and computational techniques developed were applied to study the interaction of thermal plumes above multiple concentrated heat sources. The mathematical theory and computational techniques associated with reconstruction of a field from its projections were critically reviewed. Three-dimensional reconstruction as opposed to two-dimensional reconstruction on a set of parallel cross-sectional planes was considered. The results showed that three-dimensional reconstruction was better. For the range of viewing angle of 45 degrees the maximum error in three-dimensional reconstruction was only half the maximum error in two-dimensional reconstruction. Three-dimensional reconstruction is necessary for the application of a priori knowledge of the field equations and for the strongly refracting fields. Dissert. Abstr.

N78-17357* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PROJECTION SYSTEM FOR DISPLAY OF PARALLAX AND PERSPECTIVE Patent
Robert L. Kurtz, inventor (to NASA) Issued 27 Dec. 1977 4 p Filed 6 Nov. 1975 Supersedes N76-13909 (14 - 04, p 0511) (NASA-Case-MFS-23194-1; US-Patent-4,065,202; US-Patent-Appl-SN-629458; US-Patent-Class-350-3.5) Avail: US Patent Office CSCL 20E

A projection system for the display of parallax and perspective of a real image from a hologram is presented. A reference beam was projected in a sequence of several projections at selected angles of perspective through the hologram, this sequence being rapidly performed. The resulting angular spaced images emitting from the hologram were directed onto a mirror which was coordinately tilted to reflect all of the resulting images to register onto a screen where they appeared as a single three dimensional image. Official Gazette of the U.S. Patent Office

N78-17358* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MICROBALANCE Patent
Lee O. Heflinger (TRW, Inc., Redondo Beach, Calif.) and Ralph F. Wuerker, inventors (to NASA) Issued 3 Feb. 1970 6 p Filed 8 May 1967 Sponsored by NASA
(NASA-Case-MSC-11242; US-Patent-3,492,858; US-Patent-Appl-SN-636796; US-Patent-Class-73-67.2) Avail: US Patent Office CSCL 14B

A reed is vibrated by the minute vibrations of a base frame which, in turn, is vibrated by a driver mechanism. The vibration of the reed is picked off and fed back to the driver means, causing the base frame to be vibrated at the resonant frequency of the reed. A counter is connected to the feedback loop to measure the frequency of the reed oscillations. By adding the mass to be weighed to the reed, the resonant frequency of the reed will be changed, which will in turn change the reading at the counter by an amount which is proportional to the added mass. Official Gazette of the U.S. Patent Office.

N78-17359* National Aeronautics and Space Administration. Pasadena Office, Calif.
PRESSURE TRANSDUCER Patent
Alan Rembaum, inventor (to NASA) (JPL) Issued 8 Feb. 1972 4 p Filed 18 Sep. 1969 Sponsored by NASA
(NASA-Case-NPO-11150; US-Patent-3,641,470; US-Patent-Appl-SN-858950; US-Patent-Class-338-99;

US-Patent-Class-338-36; US-Patent-Class-338-100) Avail: US Patent Office CSCL 14B

A pressure transducer is described in which the sensing element is a crystal of the monomeric charge transfer complex of pyrene and tetracyanoethylene. A.H.

N78-17360*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NASA GROUND-BASED AND SPACE-BASED LASER RANGING SYSTEMS
Michael W. Fitzmaurice Jan. 1978 28 p refs
(NASA-TP-1149; G-7802-F03) Avail: NTIS HC A03/MF A01 CSCL 20E

Laser ranging is expected to help unlock the mysteries of the earthquake phenomenon by producing unique results of crustal motions of the Earth. The current state of the art and future projections are presented, including principal applications and characteristics of typical systems. Author

N78-17361# Naval Research Lab., Washington, D. C.
CHARACTERISTICS OF SOME 35-MM FILMS FOR HOLOGRAPHY AT 694.3 NM Interim Report
R. L. Easton, Jr. and J. A. Blodgett 12 Sep. 1977 13 p refs (RR0110741)
(AD-A047413; AD-E000044) Avail: NTIS HC A02/MF A01 CSCL 14/5

Measurements of modulation transfer functions, signal-to-noise ratios, and sensitivities have been made for several 35-mm films in preparation for a study of long-distance holographic imaging in Q-switched ruby laser light (694.3 nm).Author (GRA)

N78-17362# Army Engineer Topographic Labs., Fort Belvoir, Va.
HOLOGRAPHIC OPTICAL ELEMENTS WITH LOW Q-FACTORS Research Note, 1975 - 1976
William R. Graver Oct. 1977 47 p refs
(AD-A047825; ETL-0123) Avail: NTIS HC A03/MF A01 CSCL 20/6

Holographic optical elements, with low Q-factors, are theoretically modeled and experimentally constructed. An optical performance evaluation yields a low reconstruction angle sensitivity of 14 degrees, a high diffraction efficiency of 50 percent, and an optical path deviation of lambda/4. Author (GRA)

N78-17363# Institut Franco-Allemand de Recherches, St. Louis (France).
LDA DATA ACQUISITION SYSTEMS WITH HIGH ACCURACY AND HIGH DATA RATE
M. Koenig and H. J. Pfeifer 18 Apr. 1977 12 p refs Presented at the 7th Intern. Congr. on Instr. in Aerospace Simulation Facilities, Shrivenham, Engl., 6-8 Sep. 1977
(ISL-CO-205/77) Avail: NTIS HC A02/MF A01

A novel digital data acquisition system for laser anemometry is described. This system, especially designed for high speed applications where both high accuracy and high data rate are required, consists basically of a single counter technique with data validity check. In order to obtain extremely low measuring errors of the individual velocity samples a new electronic device is used which avoids the count ambiguity of former data acquisition systems. Author (ESA)

N78-17364# Technical Research Centre of Finland, Espoo. Instrument Lab.
CONSTRUCTION OF SOME INSTRUMENTS FOR MEASURING AND CREATING MAGNETIC FIELDS Ph.D. Thesis - Helsinki Univ. of Technol.
Vaeinoe Kelhae, O. 6 May 1977 24 p refs Sponsored by Jenny and Antti Wihuri Found.
(VTT-GD-3; ISBN-951-38-0447-X) Avail: NTIS HC A02/MF A01

The construction of different instruments for the measurement of magnetic susceptibility of copper-iron alloy during tensile testing in order to follow the martensite transformation of iron continuously; hysteresis loop of hard magnetic materials, like barium and strontium ferrites and PtCo-alloys, in the form of flat cylinders with Hall probes; magnetic induction more than 1 mT with rotating coil magnetometer to calibrate reference magnets with an accuracy better than 0,05%; and for the creation of demagnetizing field for benefication processes is presented. Basic physical principles, theoretical and practical design considerations, construction techniques and calibration, and testing procedures of the instruments are discussed in detail. Author (ESA)

36 LASERS AND MASERS

Includes parametric amplifiers.

N78-17365 Rochester Univ., N. Y.
INVESTIGATION OF DYE LASER EXCITATION OF ATOMIC SYSTEMS Ph.D. Thesis
Joseph Anthony Abate 1977 123 p
Avail: Univ. Microfilms Order No. 77-25425

A stabilized cw dye laser system and an optical pumping scheme for a sodium atomic beam were developed, and the improvements over previously existing systems are discussed. A method to stabilize both the output intensity and the frequency of the cw dye laser for periods of several hours is described. The fluctuation properties of this laser are investigated by photon counting and two-time correlation measurements. The results show significant departures from the usual single-mode laser theory in the region of threshold and below. The implications of the deviation from accepted theory, are discussed. The atomic beam system that was constructed and tested is described. A method of preparing atomic sodium so that it behaves as a simple two-level atom is outlined, and the results of some experiments to study the resonant interaction between the atoms and the dye laser beam are presented. Dissert. Abstr.

N78-17366* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
GAS ION LASER CONSTRUCTION FOR ELECTRICALLY ISOLATING THE PRESSURE GAUGE THEREOF Patent
Charles E. Wood (TRW Inc., Redondo Beach, Calif.) and Robert S. Witte, inventors (to NASA) Issued 6 May 1975 5 p Filed 10 Sep. 1973 Sponsored by NASA
(NASA-Case-MFS-22597; US-Patent-3,882,417; US-Patent-Appl-SN-395895; US-Patent-Class-331-94.5T; US-Patent-Class-315-108; US-Patent-Class-331-94.5G) Avail: US Patent Office CSCL 20E

The valve and the pressure gauge of a gas ion laser were electrically insulated from the laser discharge path by connecting them in series with the cathode of the laser. The laser cathode can be grounded and preferably is a cold cathode although a hot cathode may be used instead. The cold cathode was provided with a central aperture to which was connected both the pressure gauge and the gas pressure reservoir through the valve. This will effectively prevent electric discharges from passing either to the pressure gauge or the valve which would otherwise destroy the pressure gauge. Official Gazette of the U.S. Patent Office

N78-17367*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A VERSATILE LDV BURST SIMULATOR Patent Application
Otto Youngbluth, Jr., inventor (to NASA) Filed 16 Dec. 1977 15 p
(NASA-Case-LAR-11859-1; US-Patent-Appl-SN-861396) Avail: NTIS HC A02/MF A01 CSCL 20E

A device that generates burst signals which were suitable for determining whether or not a laser Doppler velocimeter was operating properly is described. Means are presented for independently varying the information and pedestal frequencies, for adding asymmetry to the generated burst pulses, and for selecting several different combinations of burst signals. NASA

N78-17368*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APPROXIMATE ANALYTIC SOLUTIONS FOR THE OPTICAL PUMPING OF FLUORESCENT DYES
Nabil M. Lawandy Jan. 1978 17 p refs Submitted for publication
(NASA-TM-78072; G7802-12) Avail: NTIS HC A02/MF A01 CSCL 02E

A general technique for solving a system of rate equations

describing the interaction of an electromagnetic field and a molecular system is presented. The method is used to obtain approximate time-dependent solutions for the upper-level population of fluorescent dyes in the presence of a pump field.
Author

N78-17369*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NANOSECOND TIME TRANSFER VIA SHUTTLE LASER RANGING EXPERIMENT
Victor S. Reinhardt, Don A. Premo, Michael W. Fitzmaurice, S. Clark Wardrip, and Peter O. Cervenka (Phoenix Corp., McLean, Va.) Jan. 1978 26 p refs Presented at NASA/DOD PTTI Meeting, Greenbelt, Md., 29 Nov. - 1 Dec. 1977
(NASA-TM-78073) Avail: NTIS HC A03/MF A01 CSCL 20E

A method is described to use a proposed shuttle laser ranging experiment to transfer time with nanosecond precision. All that need be added to the original experiment are low cost ground stations and an atomic clock on the shuttle. It is shown that global time transfer can be accomplished with 1 ns precision and transfer up to distances of 2000 km can be accomplished with better than 100 ps precision. Author

N78-17370# Avco-Everett Research Lab., Everett, Mass.
INVESTIGATION OF ELECTRON IMPACT PROCESSES RELEVANT TO VISIBLE LASERS Semiannual Report, 1 Mar. - 31 Aug. 1977
M. John W. Boness and H. A. Hyman 31 Aug. 1977 57 p refs
(Contract N00014-74-C-0064; DARPA Order 1806)
(AD-A047685) Avail: NTIS HC A04/MF A01 CSCL 20/5

The emphasis of the work during the reporting period has been placed upon the design and optimization of a glow discharge source of metastable atoms which was subsequently installed in the electron spectrometer system. As a consequence of signal-to-noise problems and long term stability limitations encountered with the energy loss spectroscopy the experiment has been modified and a fluorescence diagnostic substituted for the electrostatic electron energy analyzer. Preliminary experiments involving electron-ground state atoms have been performed in order to evaluate the sensitivity of the fluorescence technique. Numerous experimental modifications have been performed in order to reduce the principal source of noise, namely fluorescence emission from the discharge source. GRA

N78-17371# Avco-Everett Research Lab., Everett, Mass.
ONE METER KrF LASER SYSTEM Semiannual Report, 23 Aug. 1976 - 22 Feb. 1977
J. C. Hsia, J. H. Jacob, J. A. Mangano, and M. Rokni 22 Feb. 1977 94 p refs
(Contract N00014-76-C-1032; DARPA Order 3125)
(AD-A047684) Avail: NTIS HC A05/MF A01 CSCL 20/5

This interim report covers research directed towards electron beam and electron beam sustained discharge pumping of rare gas-halide lasers. The key issues being addressed are: (1) upper laser level formation and quenching, (2) laser medium gain and absorption, (3) laser energy extraction, (4) kinetic modeling, (5) attainable laser efficiency and energy scaling, and (6) spatial uniformity in excitation. Using a magnetically guided E-beam to pump a KrF laser, 102 joules of laser output were obtained in an active laser volume of 8.5 liters with 9% intrinsic laser efficiency. Laser performance agree with predictions of the kinetic model over the range of operating conditions investigated.
Author (GRA)

N78-17372# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
A STUDY OF LASER ABSORBER IR282 IN PLASTIC AND LIQUID MEDIA
Lloyd C. Bobb and Emmanuel A. Lucia Sep. 1977 25 p refs
(AD-A047381; AD-E400014; ARLCD-TR-77046) Avail: NTIS HC A02/MF A01 CSCL 20/5

A PMMA Air Force visor with 1.06 micron absorber IR282 and .53 micron absorber K283 was studied for its utility as a laser protective material. The visor material was found to have an optical density approx. 6 at 1.06 micron and approx. 4 at .53 micron with a luminous transmittance of 44%. More bleaching was observed at high irradiance levels for IR282 in PMMA than in MMA. Pulse narrowing effects were noted and taken into account for the optical density calculations. An explanation is given for the shape of the transmitted pulse. Author (GRA)

N78-17373# Sanders Associates, Inc., Nashua, N. H. Defensive Systems Div.
ENERGY TRANSFER IN A RARE EARTH DOPED ACTIVATOR-ACTIVATOR SYSTEM Final Report
E. P. Chicklis and C. S. Naiman Oct. 1977 60 p refs
(Contract F44620-76-C-0111)
(AD-A047468; AFOSR-77-1289TR) Avail: NTIS MF A01 CSCL 20/5

This report summarizes research carried out to investigate energy transfer in an activator-activator system; that is a system for which energy transfer is reversible between certain metastable levels and for which stimulated emission from each of these levels can be generated. The specific system investigated is Er-Ho:YLF. Laser operation from two different ions in the same solid state host has been demonstrated. The 750nm (5S(2) - 5I(7):Ho) and 850nm (4S(3/2) 4I(13/2:Er) transitions were observed simultaneously and separately at 77K. Cross transfer between the S levels was also observed and the cross transfer rates measured in crystals of five different compositions. Cross transfer between the S levels is mitigated by other cross relaxation transfer schemes which quench the S level storage time of each ion. Only about 25% of the initial population of one ion is transferred to the other in the optimum concentration, 2%Ho-2%Er, at room temperature. The cross transfer rate is only weakly temperature and concentration dependent; at low temperatures cross transfer is somewhat more effective as the decay rates of each ion are longer. GRA

N78-17374# Northrop Research and Technology Center, Hawthorne, Calif.
HIGH POWER SHORT WAVELENGTH LASER DEVELOPMENT Final Technical Report, 1 Jul. 1976 - 30 Sep. 1977
D. B. Cohn and W. B. Lacina Nov. 1977 173 p refs
(Contract N00014-76-C-1100)
(AD-A047746; NRTC-77-43R) Avail: NTIS HC A08/MF A01 CSCL 20/5

Results of a comprehensive experimental and theoretical investigation of a large volume, electron beam and discharge excited KrF laser are reported. For pulse lengths approx. 1 microsec, maximum specific energy extraction was 22 J/liter at 10% efficiency and maximum total energy was 90J for a 10 liter gain volume. Discharge enhancement of output energy was limited by discharge instability as a result of beam deposition nonuniformity. Excellent agreement in terms of absolute values and waveforms was obtained with an extensive computer code.
Author (GRA)

N78-17375# Army Environmental Hygiene Agency, Aberdeen Proving Ground, Md.
STANFORD RESEARCH INSTITUTE LIGHT DETECTION AND RANGING, LIDAR, SYSTEM MARK 9 LASERS, 22 SEPTEMBER 1977
Pedro F. DelValle and Darius J. Crews 7 Dec. 1977 8 p
(AD-A047510; USAEHA-42-0331-78) Avail: NTIS HC A02/MF A01 CSCL 06/18

A special study of optical radiation hazards was performed on two light detection and ranging system lasers. Both lasers were Class IV high power lasers. The protection standard for intrabeam viewing could be exceeded out to a range of 9.9 km for the ruby laser and 210 m for the CO2 laser. Author (GRA)

N78-17376# Naval Research Lab., Washington, D. C.
DARPA-NRL LASER PROGRAM Semiannual Technical Report, 1 Oct. 1976 - 30 Mar. 1977
Sep. 1977 84 p refs
(AD-A047407; AD-E000019; NRL-MR-3580) Avail: NTIS HC A05/MF A01 CSCL 20/5

The DARPA-NRL Laser Program is concerned with the development of laser technology of electronic state lasers and associated physics. In particular the development of the XeF laser has been emphasized. Experimental and theoretical efforts were made to understand and improve laser performance. The radiative lifetime of XeF was measured by photolytic dissociation of XeF2. A short pulse electron beam device was set up to

remeasure the XeF lifetime more accurately and work was started to synthesize KrF2 in order to measure the lifetime of KrF. Values for the radiative lifetime are used in a code to predict laser performance of both XeF and KrF. Experimentally the performance of the XeF laser has been improved. Long laser pulses were observed for the first time and laser efficiency was increased by substitution of Ne for Ar, the diluent. Absorption measurements combined with code calculations showed that the improvement was due to decreased dimer ion optical absorption. GRA

N78-17377# Naval Research Lab., Washington, D. C.
FAST IONS FROM LASER PLASMAS: ANALYTIC SOLUTION AND SCALING LAWS
F. S. Felber and R. Decoste Sep. 1977 12 p refs
(AD-A047399; AD-E000016; NRL-MR-3578) Avail: NTIS HC A02/MF A01 CSCL 20/7

New analytic solutions describe ambipolar acceleration of fast ions from a steep, localized density gradient with a high electron temperature. A scaling law and estimates for the peak energy of ion species are presented. Author (GRA)

N78-17378# Naval Research Lab., Washington, D. C. Laser Plasma Branch.
STEADY-ABLATION MODEL OF ACCELERATING LASER-TARGET SLABS Interim Report
F. S. Felber Sep. 1977 14 p refs Sponsored by ERDA
(AD-A047400; AD-E000017; NRL-MR-3569) Avail: NTIS HC A02/MF A01 CSCL 20/5

A steady-state model of a plasma slab, accelerated by interaction with laser radiation, determines temperature, velocity, and density profiles and boundaries consistent with laser intensity and wavelength, and slab mass and acceleration. Density profile modification is caused by laser pressure. Plasma flows subsonically into the critical surface, supersonically out. Author (GRA)

N78-17379# Naval Research Lab., Washington, D. C. Laser Plasma Branch.
SOME RAYLEIGH-TAYLOR STABILIZING MECHANISMS IN THIN LASER TARGETS Interim Report
F. S. Felber and S. E. Bodner Aug. 1977 17 p refs Sponsored by ERDA
(AD-A047401; AD-E000018; NRL-MR-3574) Avail: NTIS HC A02/MF A01 CSCL 20/5

Several mechanisms that reduce the linear growth rate and severity of Rayleigh-Taylor instability in thin, inhomogeneous laser targets are discussed. Author (GRA)

N78-17380# Technology, Inc., San Antonio, Tex. Life Sciences Div.
RESEARCH ON THE OCULAR EFFECTS OF LASER RADIATION Final Report, 16 Feb. 1975 - 30 Nov. 1976
Joseph A. Zuclich, J. Terry Yates, A. David Nawrocki, William H. Bowie, and Ronald F. Lemberger 5 Aug. 1977 207 p refs
(Contract F41609-73-C-0017)
(AD-A043457; TI-77-0561-03) Avail: NTIS HC A10/MF A01 CSCL 06/18

Contents: Ocular Effects of Visible and Near-Infrared Laser Radiation -- Large Retinal Lesions, Retinal Photochemistry, In Vivo Retinal Probe Experiments, Effects of Laser Radiation on Retinal Lipids, and Ocular Histopathology and Electron Microscopy; Ocular Effects of Ultraviolet Laser Radiation -- Corneal Damage Induced by Near-UV Laser Radiation, Oxygen Dependence of Near-UV Induced Corneal Damage, Action Spectrum for Near-UV Induced Corneal Damage, and Lenticular Effects of Near-UV Laser Radiation; Neurophysiology and Physiological Optics -Visual Evoked Response, and Physiological Optics. GRA

N78-17381# Stanford Univ., Calif. Edward L. Ginzton Lab.
TUNABLE LASERS AND COHERENT LIGHT TECHNIQUES FOR HIGH RESOLUTION ULTRAVIOLET SPECTROSCOPY Technical Report, 1 Jan. - 31 Dec. 1977
Theodor W. Haensch Dec. 1977 31 p refs
(Contract N00014-75-C-0841)
(AD-A048225; GL-2758; TR-6) Avail: NTIS HC A03/MF A01 CSCL 20/5

This report summarizes recent efforts towards the development, improvement, and use of tunable laser systems and novel coherent light techniques for high resolution ultraviolet spectroscopy of atoms and molecules. It reports on: (1) studies of atomic hydrogen and deuterium by Doppler-free ultraviolet laser spectroscopy, which have yielded new precision values of the 1S-2S isotope shift and of the 1S ground state Lamb shift; (2) the first demonstration of a novel technique of high resolution laser spectroscopy, using coherent two-photon excitation with multiple light pulses; (3) the status of a search for a hydrogen-laser-pumped tunable ultraviolet laser; and (4) the observation of a quenching of the laser action in xenon fluoride excimer lasers by the vapor of xenon difluoride. GRA

N78-17382# Institut Franco-Allemand de Recherches, St. Louis (France).
PARAMETRIC INVESTIGATIONS OF LARGE AREA ELECTRON BEAM SOURCES [PARAMETRISCHE UNTERSUCHUNGEN AN GROSSFLAECHIGEN ELEKTRONENSTRAHLQUELLEN]
M. Hugenschmidt, K. Vollrath, and W. Baca 13 Sep. 1976 26 p refs In GERMAN Original contains color illustrations (ISL-R-127/76) Avail: NTIS HC A03/MF A01

The construction and investigations of high power pulsed field emission electron sources to be used for gas laser injection are described. Parameters are current density and pulse shape as a function of the electrode configurations as well as of window thickness (in Al, Ti). Results obtained with a small model led to the construction of a large area radiation source (300 sq cm). The homogeneity of the electron current density distribution was determined with electric sondes and by photographic recording of the intensity distribution in the visible range on a fluorescent screen. ESA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N78-17383* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ADJUSTABLE SECURING BASE Patent
Paul P. Zebus (Rockwell International, Downey, Calif.) and Poley N. Packer, inventors (to NASA) (Rockwell International, Downey, calif.) Issued 3 Jan. 1978 5 p Filed 7 Sep. 1976 Supersedes N76-31529 (14 - 22, p 2872) Sponsored by NASA
(NASA-Case-MSC-19666-1; US-Patent-4,066,039;
US-Patent-Appl-SN-721150; US-Patent-Class-118-500;
US-Patent-Class-118-50; US-Patent-Class-51-235;
US-Patent-Class-248-36-3; US-Patent-Class-269-21;
US-Patent-Class-279-3) Avail: US Patent Office CSCL 13I

An adjustable securing base had a surface radius of curvature which was adjusted to support an adjacent part on the base surface. The securing base comprised of a flexible thin plate with an adjustment mechanism connected on opposite edges of the base for adjusting the plate curvature. An opening in the plate was coupled to a vacuum device for securing the part adjacent to the plate surface.
Official Gazette of the U.S. Patent Office

N78-17384* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VARIABLE CYCLE GAS TURBINE ENGINES Patent
James Edward Johnson (GE, Cincinnati) and Tom Foster, inventors (to NASA) (GE, Cincinnati) Issued 27 Dec. 1977 10 p Filed 2 Jun. 1975 Sponsored by NASA
(NASA-Case-LEW-12916-1; US-Patent-4,064,692;
US-Patent-Appl-SN-583056; US-Patent-Class-60-261;
US-Patent-Class-60-262; US-Patent-Class-60-271) Avail: US Patent Office CSCL 21E

A technique, method, and apparatus were designed for varying the bypass ratio and modulating the flow of a gas turbine engine in order to achieve improved mixed mission performance. Embodiments include gas flow control system for management of core and bypass stream pressure comprising diverter valve means downstream of the core engine to selectively mix or separate the core and bypass exhaust streams. The flow control

system may also include variable geometry means for maintaining the engine inlet airflow at a matched design level at all flight velocities. Earth preferred embodiment thus may be converted from a high specific thrust mixed flow cycle at supersonic velocities to a lower specific thrust separated flow turbofan system at subsonic velocities with a high degree of flow variability in each mode of operation. Official Gazette of the U.S. Patent Office

N78-17385* National Aeronautics and Space Administration. Pasadena Office, Calif.

WABBLE GEAR DRIVE MECHANISM Patent

Francis J. Winiarski, inventor (to NASA) (TRW Inc., Redondo Beach, Calif.) Issued 28 Feb. 1967 5 p Filed 24 Apr. 1964 Sponsored by NASA

(NASA-Case-WOO-00625; US-Patent-3,306,134; US-Patent-Appl-SN-362278; US-Patent-Class-74-800) Avail: US Patent Office CSCL 13I

The wabble gear principle was applied in the design of a driving mechanism for controlling spacecraft solar panels. The moving elements, other than the output gear, are contained within a hermetically sealed package to prevent escape of lubricants and ingestion of contaminant particles. The driving gear contains one more tooth than the output gear on a concave, conical pitch surface of slightly larger apex angle. The two gears mesh face to face such that engagement takes place at one point along the circumference. The driving gear is not permitted to rotate by virtue of its attachment through the bellows which permits flexure in the pitch and yaw position, but not in roll. As the bearing carrier rotates, the inclined mounting of the bearing causes the driving gear to perform a wabbling, irrotational motion. This wabbling motion causes the contact point between the output gear and the driving gear to traverse around the circumference of the gears once per revolution of the bearing carrier. A.R.H.

N78-17386* National Aeronautics and Space Administration. Pasadena Office, Calif.

APPARATUS FOR HANDLING MICRON SIZE RANGE PARTICULATE MATERIAL Patent

Joseph F. Friichtenicht (TRW, Inc., Redondo Beach, Calif.) and Neal L. Roy, inventors (to NASA) (TRW, Inc., Redondo Beach, Calif.) Issued 4 Jun. 1968 6 p Filed 6 May 1964 Sponsored by NASA

(NASA-Case-NPO-10151; US-Patent-3,387,218; US-Patent-Appl-SN-365244; US-Patent-Class-328-233) Avail: US Patent Office CSCL 13I

An apparatus for handling, transporting, or size classifying comminuted material was described in detail. Electrostatic acceleration techniques for classifying particles as to size in the particle range from 0.1 to about 100 microns diameter were employed. Official Gazette of the U.S. Patent Office

N78-17387*# Avco Lycoming Engine Group, Stratford, Conn.

DEVELOPMENT OF SPIRAL-GROOVE SELF-ACTING FACE SEALS Final Report, 9 Feb. 1976 - 31 Mar. 1977

M. OBrien Jun. 1977 141 p refs Sponsored in part by Army Air Mobility R and D Lab

(Contract NAS3-19772)

(NASA-CR-135303; LYC-77-41) Avail: NTIS HC A07/MF A01 CSCL 11A

An experimental evaluation and a 100-hour endurance test were performed on a spiral groove geometry, self-acting face seal. The seal was tested and operated successfully at maximum conditions of 243.8 m/s surface speed, 199.9 N/sq cm air pressure, and 645.4K (702 F) air temperature. The maximum speed condition of 243.8 m/s was obtained at a shaft speed of 72,500 rpm. Seal wear, gas leakage, and sealing element temperature were monitored during the test. Condition of the seal at the completion of the test was documented and found acceptable for further use. The spiral groove wear rate measured during the endurance test indicates a minimum potential seal life of over 2700 hours. Seal air leakage measured during the test program is within the range considered acceptable for consideration for use in a small gas turbine engine. Author

N78-17388*# Licht (L.), San Mateo, Tex.

FOIL BEARINGS FOR AXIAL AND RADIAL SUPPORT OF HIGH SPEED ROTORS: DESIGN, DEVELOPMENT, AND DETERMINATION OF OPERATING CHARACTERISTICS Final Report

L. Licht Jan. 1978 170 p refs

(NASA Order C-75012-C; Contract N00014-76-C-0191)

(NASA-CR-2940) Avail: NTIS HC A08/MF A01 CSCL 13I

Flexible surface thrust and journal foil bearings were fabricated, and their performance was demonstrated, both individually and jointly as a unified rotor support system. Experimental results are documented with graphs and oscilloscopic data of trajectories, waveforms, and scans of amplitude response. At speeds of 40,000 to 45,000 rpm and a mean clearance of the order of 15 to 20 micrometers (600 to 800 micrometers, the resilient, air lubricated, spiral groove thrust bearings support a load of 127 N (29 lb; 13 kgf), equivalent to 3.0 N/sq cm (4.5 lb/sq in 0.31 kgf sq cm). Journal bearings with polygonal sections provided stable and highly damped supports at speeds up to 50,000 rpm. Author

N78-17389*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

BEARING, GEARING, AND LUBRICATION TECHNOLOGY

William J. Anderson 1978 24 p refs Presented at the 1978 Automotive Eng. Congr. and Exposition, Detroit, 27 Feb. - 3 Mar. 1978; sponsored by SAE

(NASA-TM-73851) Avail: NTIS HC A02/MF A01 CSCL 13I

Results of selected NASA research programs on rolling-element and fluid-film bearings, gears, and elastohydrodynamic lubrication are reported. Advances in rolling-element bearing material technology, which have resulted in a significant improvement in fatigue life, and which make possible new applications for rolling bearings, are discussed. Research on whirl-resistant, fluid-film bearings, suitable for very high-speed applications, is discussed. An improved method for predicting gear pitting life is reported. An improved formula for calculating the thickness of elastohydrodynamic films (the existence of which help to define the operating regime of concentrated contact mechanisms such as bearings, gears, and cams) is described. Author

N78-17390*# Stein Seal Co., Philadelphia, Pa.

FEASIBILITY STUDY OF NEGATIVE LIFT CIRCUMFERENTIAL TYPE SEAL FOR HELICOPTER TRANSMISSIONS

E. N. Goldring Oct. 1977 38 p

(Contract NAS3-20598)

(NASA-CR-135302) Avail: NTIS HC A03/MF A01 CSCL 11A

A new seal concept, the negative lift circumferential type seal, was evaluated under simulated helicopter transmission conditions. The bore of the circumferential seal contains step type geometry which produces a negative lift that urges the sealing segments towards the shaft surface. The seal size was a 2.5 inch bore and the test speeds were 7000 and 14,250 rpm. During the 300 hour test at typical transmission seal pressure (to 2 psig) the leakage was within acceptable limits and generally less than 0.1 cc/hour during the last 150 hours of testing. The wear to the carbon segments during the 300 hours was negligible. Author

N78-17391*# National Aeronautics and Space Administration. Pasadena Office, Calif.

A SPEED CONTROL DEVICE FOR A HEAVY DUTY SHAFT Patent Application

Allen G. Ford, inventor (to NASA) (JPL) Filed 13 Dec. 1977 16 p

(Contract NAS7-100)

(NASA-Case-NPO-14170; US-Patent-Appl-SN-860404) Avail: NTIS HC A02/MF A01 CSCL 13I

A device was provided through which the angular velocity of a heavy duty shaft was mechanically compared to that of a reference speed shaft, and detected error in the velocity of the heavy duty shaft was eliminated. NASA

N78-17392# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Mechanical Engineering.

AN EXPERIMENTAL STUDY OF SURFACE TEMPERATURES GENERATED AT THE SOLID-SOLID INTERFACE Final Report

Michael J. Furey Nov. 1977 23 p refs

(Grant DA-ARO(D)31-124-73-G-146)
(AD-A047735; VPI-E-77-27; ARO-10887-1-E) Avail: NTIS HC A02/MF A01 CSCL 20/11

This is a final report on the first phase of an experimental investigation of surface temperatures generated by sliding contact between solids. Emphasis is on the determination of surface temperatures by means of a geometrically simple but functionally sophisticated device built around the use of an infrared microscope. The device consists basically of a fixed specimen (e.g., sphere, cylinder, flat, or cone) loaded against a thin rotating disc transparent to infrared radiation, in this case an optically flat sapphire disc 1mm thick. Since the target spot size is much smaller than the region of macroscopic elastic or plastic contact, it is possible to scan the contact region by moving the infrared microscope very precisely in the horizontal x-y plane. With this apparatus, applied loads can be varied from 0.1 to 10N while sliding velocities from .001 to more than 10m/s can be achieved. Measurements made include radiance, emissivity, friction, and area of contact and surface damage information obtained from scanning electron micrographs. Using this method, the surface temperature and tribological behavior of several model systems (e.g., various polymers, graphite) was investigated and the results compared with existing theory. As an example, it has been possible (1) to measure the detailed temperature distribution over a tiny region of elastic (Hertz) or plastic contact in a dry sliding system and (2) to relate this information to real areas of contact. GRA

N78-17393# Institut Franco-Allemand de Recherches, St. Louis (France).
EXPERIMENTAL STUDIES ON TERMINAL BALLISTICS OF KINETIC ENERGY PROJECTILES
G. Weihrauch and H. F. Lehr 28 Feb. 1977 16 p refs Presented at the 3rd Intern. Symp. on Ballistics, Karlsruhe, West Ger., 23-25 Mar. 1977
(ISL-CO-202/77) Avail: NTIS HC A02/MF A01

A general review is given on the experimental basic research in ISL with regard to impact phenomena of kinetic energy projectiles into metallic targets. As a study of the beginning impact, the plastic deformation of both projectiles and target is described in the case of hollow cylinders and solid projectiles of different tip forms striking at velocities from 1200 to 1500 m/s. The targets were inclined from 0 to 70 deg. As projectile/target configurations copper/aluminum and heavy-metal/steel are presented. Tests with nondeforming projectile tips are also treated. The accumulation of target material thereby produces nose shapes which are not necessarily identical with the original form. As a result construction details of the tips of blunt projectiles have only a minor effect on the nose being formed; however, there is a dependence on penetration velocity. In describing target deformation in front of a penetrating projectile, the vectors of displacement of single mass points, trajectories, deformation velocities, and the flow of target material around the projectile are shown for an ogival core. The deformation behavior of projectiles of different materials impacting homogeneous and structured targets of diverse materials is also mentioned. Information is given on temperature measurements, performed on hydrodynamically penetreting projectiles and on plugs emanating from the rear side of the armour plate. Author (ESA)

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N78-17394 Stanford Univ., Calif.
LIFE TESTING WITH INCOMPLETE OBSERVATIONS Ph.D. Thesis
John Edwin Hyde, III 1977 86 p
Avail: Univ. Microfilms Order No. 77-25681

A method to generalize the Wilcoxon-Mann-Whitney procedure to the case of right censored data with equal censoring in two samples was developed. For large samples, evidence is presented via tables which indicates that the variance formula for equal censoring is a good approximation for the true variance in wide classes of problems. A simple rule is given for identifying these situations. A method is also presented for generating exact, nonparametric tests of survival under equal censoring. These tests permit the use of standard tables. In a second section the additional possibility of left truncation was considered. Martingale techniques, in conjunction with the Central Limit Theorem, were applied to establish the asymptotic normality of a particular one-sample test statistics. Dissert. Abstr.

N78-17395* National Aeronautics and Space Administration. Pasadena Office, Calif.
CROSS CORRELATION ANOMALY DETECTION SYSTEM Patent
Ernest Z. Micka, inventor (to NASA) (JPL) Issued 23 Sep. 1975 13 p Filed 27 Feb. 1973 Sponsored by NASA
(NASA-Case-NPO-13283; US-Patent-3,908,118; US-Patent-Appl-SN-401225; US-Patent-Class-235-181; US-Patent-Class-235-151.3; US-Patent-Class-235-156; US-Patent-Class-250-572; US-Patent-Class-356-237) Avail: US Patent Office CSCL 14D

This invention provides a method for automatically inspecting the surface of an object, such as an integrated circuit chip, whereby the data obtained by the light reflected from the surface, caused by a scanning light beam, is automatically compared with data representing acceptable values for each unique surface A signal output is provided indicative of acceptance or rejection of the chip. Acceptance is based on predetermined statistical confidence intervals calculated from known good regions of the object being tested, or their representative values. The method can utilize a known good chip, a photographic mask from which the I.C. was fabricated, or a computer stored replica of each pattern being tested. Official Gazette of the U.S. Patent Office

N78-17396* National Aeronautics and Space Administration. Pasadena Office, Calif.
AUTOMATIC VISUAL INSPECTION SYSTEM FOR MICROELECTRONICS Patent
Ernest Z. Micka, inventor (to NASA) (JPL) Issued 30 Sep. 1975 13 p Filed 27 Sep. 1973 Sponsored by NASA
(NASA-Case-NPO-13282; US-Patent-3,909,602; US-Patent-Appl-SN-401224; US-Patent-Class-235-151.3; US-Patent-Class-235-156; US-Patent-Class-250-563; US-Patent-Class-250-572; US-Patent-Class-356-165; US-Patent-Class-356-237) Avail: US Patent Office CSCL 14D

A system for automatically inspecting an integrated circuit was developed. A device for shining a scanning narrow light beam at an integrated circuit to be inspected and another light beam at an accepted integrated circuit was included. A pair of photodetectors that receive light reflected from these integrated circuits, and a comparing system compares the outputs of the photodetectors. Official Gazette of the U.S. Patent Office

N78-17397*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
USE OF AN ULTRASONIC-ACOUSTIC TECHNIQUE FOR NONDESTRUCTIVE EVALUATION OF FIBER COMPOSITE STRENGTH
Alex Vary and Kenneth J. Bowles 1978 12 p refs Presented at the 33rd Ann. Conf. of the Soc. of the Plastics Ind., Washington, D.C., 7-10 Feb. 1978
(NASA-TM-73813; E-9400) Avail: NTIS HC A02/MF A01 CSCL 14D

Details of the method used to measure the stress wave factor are described. Frequency spectra of the stress waves are analyzed in order to clarify the nature of the wave phenomena involved. The stress wave factor was measured with simple contact probes requiring only one-side access to a part. This is beneficial in nondestructive evaluations because the waves can run parallel to fiber directions and thus measure material properties in directions assumed by actual loads. The technique can be applied where conventional through transmission techniques are impractical or where more quantitative data are required. The stress wave factor was measured for a series of graphite/polyimide composite panels, and results obtained are compared with through transmission immersion ultrasonic scans. Author

N78-17398# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
INCLUDING FLEET USAGE VARIABILITY IN RELIABILITY ANALYSES FOR BOTH SAFETY AND ECONOMIC LIMIT Final Report, Sep. 1976 - Mar. 1977
Robert L. Neulieb Aug. 1977 21 p refs
(AD-A047714; AFFDL-TR-77-77) Avail: NTIS HC A02/MF A01 CSCL 14/4

Reliability tools have been developed which are capable of determining the probability of failing a given aircraft or the first aircraft in a fleet as a function of time, loading, and inspections. These methods, developed for the entire fleet, can easily be extended to include variations in usage across the fleet and to address the concept of economic life. Author (GRA)

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N78-17399 Texas Univ., Austin.
BEHAVIOR OF MULTIPANEL REINFORCED CONCRETE FRAMES SUBJECTED TO VERTICAL AND LATERAL LOADS Ph.D. Thesis
Donald Chief Chang 1977 359 p
Avail: Univ. Microfilms Order No. 77-22928

The behavior of multipanel reinforced concrete frames containing columns of unequal stiffness was investigated both experimentally and analytically. The full range thrust-moment-curvature relationship for the cross section typical of the most critically loaded column of the subsequent frame specimens was studied. Computer programs were utilized to generate thrust-moment-curvature relationships and to investigate the theoretical behavior of the test frames. Dissert. Abstr.

N78-17400 California Univ., Los Angeles.
DECOMPOSITION IN STRUCTURAL SYNTHESIS Ph.D. Thesis
Tze-hsin Woo 1977 179 p
Avail: Univ. Microfilms Order No. 77-25356

A structural synthesis procedure based on the Dantzig-Wolfe decomposition principle was developed for optimal plastic design. The decomposed structural synthesis problems consisted of a restricted master and a number of subproblems. Each subproblem was further divided into second level subproblems for which closed form solutions were obtained. When simplex multiplier vectors for the restricted master are viewed as velocity fields, these closed form solutions are shown to comply with the flow rule in the theory of plasticity. Theoretical convergence was established by proving the existence of a nondegenerate basic feasible solution to a restricted master. An optimal solution generated by the decomposition was shown to be a saddle point for the associated Lagrangian function, which is sufficient for global optimality. Dissert. Abstr.

N78-17401 Illinois Univ., Urbana-Champaign.
NONLINEAR ANALYSIS OF INTERSECTING CYLINDERS BY THE FINITE ELEMENT METHOD Ph.D. Thesis
Hsin-chang Chen 1977 135 p
Avail: Univ. Microfilms Order No. 77-26646

A finite element procedure is presented for the nonlinear analysis of intersecting cylinders subjected to internal pressure. The progression of yield is of particular interest. A problem of two normally intersecting cylinders under internal pressure is solved. The diameter ratio of the branch pipe to the main shell equals 1/2 and the thickness to the diameter equals 1/100 on both pipes. The elastic solution is compared with the experimental data. From the nonlinear results, it is found that yield penetrates the walls of cylinders from the inside out to the outside gradually, and the plastification starts from the region where the two cylindrical walls intersect perpendicularly, then spreads out along the intersection line with increased load. Dissert. Abstr.

N78-17402 Missouri Univ., Rolla.
STRENGTH OF COLD-FORMED STEEL BEAM WEBS IN BENDING, SHEAR, AND A COMBINATION OF BENDING AND SHEAR Ph.D. Thesis
Roger Allen Laboube 1977 200 p
Avail: Univ. Microfilms Order No. 77-23688

The load-carrying capacity of cold-formed steel web elements subjected to bending stress, shear stress, and a combination of bending and shear stresses was studied with emphasis on the instability and postbuckling strength of beam webs. For beam webs subjected only to bending, the postbuckling strength of web elements and the effect of the compression flange on the moment capacity were evaluated for beams having stiffened and unstiffened flanges. The ultimate shear strength of cold-formed steel beam webs subjected primarily to shear is affected significantly by the loading and support conditions. The structural behavior of cold-formed steel web elements subjected to combined bending and shear was also investigated. Interaction formulas have been developed to calculate the ultimate capacity of web elements with due consideration given to the postbuckling strengths for both bending and shear. Dissert. Abstr.

N78-17403 Illinois Univ., Urbana-Champaign.
FINITE ELEMENT WEIGHTED RESIDUAL METHODS FOR STATIC ANALYSIS OF REINFORCED AXISYMMETRIC SHELLS Ph.D. Thesis
Sushil Kumar Sharma 1977 123 p
Avail: Univ. Microfilms Order No. 77-26749

Finite element weighted residual methods for static analysis of reinforced axisymmetric shells were presented. The shells may have variable thickness and reinforcement along the meridian. The reinforcing material is assumed to have an orthotropic distribution along the meridional and circumferential coordinate lines. External forces on the shells may include both pressure and thermal loads which need not be axisymmetric. The derivation of the required partial differential equations of equilibrium is based on the elastic shell theory and utilizes the Love-Kirchhoff assumption. These partial differential equations were reduced to ordinary differential equations by Fourier expansions in the circumferential variable. Numerical solutions to the ordinary differential equations were then obtained for each Fourier harmonic by finite element weighted residual methods. Dissert. Abstr.

N78-17404 Illinois Univ., Urbana-Champaign.
COMPUTED BEHAVIOR OF COUPLED SHEAR WALLS Ph.D. Thesis
Takehira Takayanagi 1977 202 p
Avail: Univ. Microfilms Order No. 77-26759

The nonlinear response history and failure mechanism of coupled shear wall systems under dynamic loads and static loads were investigated through an analytical model. The analytical model was developed to predict the actual behavior of coupled shear wall systems in the highly inelastic range due to either a strong dynamic base motion or a set of static lateral loads. The walls and coupling beams were replaced by flexural elements. Axial and shear rigidities of the wall members were considered in addition to flexural rigidity in the analysis. The stiffness characteristics of each member were determined by inelastic properties such as cracking of the concrete, and yielding and bond slip of the reinforcing steel. The suitable hysteresis loops to each constituent member were established to include the specific characteristics of coupled shear wall systems.
Dissert. Abstr.

N78-17405 Stanford Univ., Calif.
APPLICATIONS OF THE FINITE ELEMENT METHOD TO THE STUDY OF PLASTIC INSTABILITIES IN TENSION Ph.D. Thesis
Michael Anthony Burke 1977 285 p
Avail: Univ. Microfilms Order No. 77-25754

The necking phenomenon in both the creep tension test and the standard tension test was studied. When the material fails in a ductile manner, an internal form of instability is oftentimes also in existence. This is attributed to the growth and coalescence of voids in the microstructure. This form of finite plastic deformation was also examined. Creep tests in tension often do not exhibit a steady state in which the overall strain rate is constant. A criterion for stable tensile flow was examined which

included the effects of rate sensitive material behavior. The point of instability was described for both the constant load and constant stress creep tests. A numerical study was described which examined the influence of various neck perturbations on the shape evolution and overall strain rate of the tension specimens. It was shown that steady state creep in tension is a formally unstable process. Dissert. Abstr.

N78-17406 Minnesota Univ., Minneapolis.
OPTIMUM STRUCTURAL DESIGN WITH FREQUENCY AND SIZE CONSTRAINTS Ph.D. Thesis
Daniel James Vavrick 1977 247 p
Avail: Univ. Microfilms Order No. 77-26170

The principle of Pontryagin was used to establish the necessary conditions and their relationship for four optimum design problems: either minimize or maximize the weight of a simple structure subject to frequency and size constraints and either minimize or maximize any single frequency of the structure subject to a total weight constraint and to thickness and other frequency constraints. The structures considered were simple one dimensional structural elements with various boundary conditions: thin walled cylinders in torsional oscillation and Euler-Bernoulli and Timoshenko sandwich beams in flexural vibration. The optimum structural design involves the solution of nonlinear two-point boundary value problems which was accomplished numerically, except in a few cases where analytic solutions were possible. Dissert. Abstr.

N78-17407 Texas Univ., Austin.
FINITE ELEMENT ANALYSIS OF TWO- AND THREE-DIMENSIONAL STATIC CONTACT OF ELASTIC BODIES Ph.D. Thesis
James Richard Koteras 1977 234 p
Avail: Univ. Microfilms Order No. 77-29057

A variational formulation is presented which describes elastic body static contact problems of general interest in engineering. Lagrange multipliers were used to represent contact forces and to enforce geometric constraints encountered in contact problems. A model using point loads along contact surfaces to represent contact forces between two bodies, was used. A continuous approximation method for tractions over contact surfaces was used as a second modelling technique. Dissert. Abstr.

N78-17408 Kansas Univ., Lawrence.
A TRIANGULAR FINITE ELEMENT FOR LAMINATED COMPOSITE PLATES INCLUDING TRANSVERSE SHEAR DEFORMATION Ph.D. Thesis
Terry L. Janssen 1977 314 p
Avail: Univ. Microfilms Order No. 77-28884

The element incorporates anisotropic material behavior, flexural membrane coupling, and transverse shear flexibility. The three corner nodes and the three midside nodes each possess five displacement degrees of freedom: three translations and two rotations. This allows the element to be easily incorporated into existing general purpose finite element programs. All derivations were performed in area coordinates and explicit shape functions are presented. The inplane displacements and the transverse shear strains were assumed to vary quadratically. The transverse displacement was assumed to be a complete quintic polynomial constrained to require the edge normal slopes to vary cubically. Static, free vibration, and bifurcation buckling analyses for flat plate idealizations were compared with alternate solutions to test and validate the element. Dissert. Abstr.

N78-17409 Georgia Inst. of Tech., Atlanta.
INVESTIGATION OF THE STRESS INTENSITY FACTORS AT SHARP CORNERS OF ARBITRARY CUTOUTS IN FINITE PLATES Ph.D. Thesis
Wen-mo Chen 1977 164 p
Avail: Univ. Microfilms Order No. 77-27636

The effect of notch angle on stress intensity factors at sharp corners was investigated. A number of finite element models were constructed for double-edge notch and single-edge notch finite plates with notch angles being equal to 0 deg, 60 deg and 90 deg. Additional study was extended to finite plates with center hairline crack, single-edge crack and a rectangular cutout. The singular elements are placed wherever the sharp corners appear, and the triangular elements will be attached adjacent to those singular elements. The accuracy and efficiency of the singular element is demonstrated by determining the stress intensity factors of simple crack configurations for which there are existing solutions. Dissert. Abstr.

N78-17410 Texas Univ., Arlington.
ANALYSIS OF PRESTRESSED HYPERBOLOIDAL SHELLS Ph.D. Thesis
ChengHsin Liao 1977 202 p
Avail: Univ. Microfilms Order No. 77-27794

Influence coefficients are used to obtain the stress resultants in a shell due to prestressing. The influence coefficients are obtained from the solutions of a set of boundary value problems, and the finite difference method is used to obtain the solutions. The critical tendon force and the natural frequencies of free vibration are obtained by the perturbation method. In the state perturbed from the prestressed one, the shell is nonaxisymmetrical. The displacements are resolved into Fourier components with respect to the circumferential direction, and their meridional derivatives are approximated by the respective finite differences. Finally, two eigenvalue problems for obtaining the critical force and the frequencies are formulated. A computer program was developed for the hyperboloidal shells and a numerical example is given. From the numerical results, due to the circumferential prestressing, conclusions are drawn regarding natural frequencies, buckling modes, and the mode shapes of free vibration. Dissert. Abstr.

N78-17411# Forschungsinstitut der Fraunhofer-Gesellschaft, Darmstadt (West Germany).
FATIGUE LIFE PREDICTION BY AMPLITUDE TRANSFORMATION
E. Haibach 1977 9 p refs Repr. from Fracture 1977. Proc. of the 4th Intern. Conf. on Fracture, (Waterloo), v. 2, 1977 p 1117-1124 Presented at the 4th Intern. Conf. on Fracture Waterloo (Ontario), Jun. 1977
Avail: NTIS HC A02/MF A01

The procedure of amplitude transformation based on the hypothesis of linear damage accumulation to improve fatigue life prediction of structural components is described. A concept enabling changes of the local mean stress and interactions resulting from a complex loading sequence was considered. The idea was to decrease or increase the nominal stress amplitude of each cycle analyzed in such a way that favorable effects of mean stress and of interactions are covered. In a computer program the degree of amplitude transformation was derived from the hysteresis loop of the local stress and strain at the fatigue critical point of stress concentration by means of a properly defined damage parameter. A conventional S-N curve, describing in terms of nominal stress the structural fatigue strength of the component under consideration, was used for calculating the damage increments of the identified cycles. Author

N78-17412# Royal Aircraft Establishment, Farnborough (England).
SIGNIFICANCE OF MEASURED LOCAL STRAINS FOR THE FATIGUE STRENGTH OF JOINTS
J. J. Gerharz and D. Schuetz Aug. 1977 43 p refs Transl. into ENGLISH from FB-128 (West Germany), 1976, Report by Laboratorium fuer Betriebsfestigkeit, Darmstadt 43 p (RAE-Lib-Trans-1935; BR60553) Avail: NTIS HC A03/MF A01

Strains around the fastener holes of joints were measured with strain gages; the parameters clamping force, fit and load transfer were varied. The arrangement of the strain gages enabled the effect of these parameters and parameter combinations on the local strains and therefore on the fatigue strength of the joint to be measured. In addition to the local stresses, the extent of secondary bending and load transfer of the fastener was calculated from the measured strains and the influence on these variables of clamping force and fit established. Through the local stresses, the effect on fatigue strength of the parameters investigated was determined quantitatively and compared with empirical data. Author

N78-17413# Lockheed Missiles and Space Co., Palo Alto, Calif.
NONSTATIONARY DIFFRACTION OF ACOUSTIC SPHERICAL AND CYLINDRICAL WAVES BY RIGID SPHERES AND

CYLINDERS
V. D. Kubenko and N. N. Panasiuk [1978] 7 p refs Transl. into ENGLISH from Prikl. Mekh. (USSR), v. 13, no. 9, 1977 p 14-20
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

A rigid sphere and cylinder were subjected to nonstationary spherical and cylindrical waves and the resulting diffraction was described. Mathematical analysis was used to describe the motions of the rigid bodies and the effects of wave front curvature on diffraction loads and the body motion. P.R.A.

N78-17414# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
ADVANTAGES OF RESIDUAL STRESSES IN DYNAMICALLY RIVETED JOINTS
Basil P. Leftheris Feb. 1978 82 p refs
(RE-552) Avail: NTIS HC A05/MF A01

An analytical method is described for calculating residual stresses in joints riveted dynamically. Results are given of the Moire experimental method for measuring the residual strain distribution around a rivet hole, and an experimental method for measuring the radial velocity of an expanding rivet is explained. The advantages of compressive residual stresses in dynamically riveted joints are demonstrated through constant amplitude fatigue testing. In the first series of tests, the fatigue life of specimens with residual stresses was approximately ten times higher than the fatigue life of specimens with open holes. In the second series, precracked specimens with a 0.05 in. crack in each hole were riveted with the Stress Wave Riveter. The fatigue loading was normal to the crack path. The fatigue life of these specimens was also approximately ten times higher than the fatigue life of those specimens with precracked holes without rivets. Author

N78-17415# Naval Ship Research and Development Center, Bethesda, Md. Computation Mathematics/Logistics Dept.
A HYBRID PROBLEM IN PLANE ELASTICITY
Surendra K. Dhir Sep. 1977 20 p refs
(AD-A047757; CMLD-77-20) Avail: NTIS HC A02/MF A01 CSCL 20/11

A fundamental problem in plane elasticity is studied: to determine for a given opening the amount and distribution of reinforcing material required to satisfy certain specified stress field criteria. The relationship between the local stress field around the opening and the reinforcement distribution is presented explicitly such that either one of them can assume the role of an independent parameter. The problem is set up as Muskhelishvili's first boundary value problem in which a function is derived to represent the loads due to reinforcement. A solution is worked out for a general mapping function which can describe almost any opening of practical interest. Numerical results and other implications for a reinforced circular opening are discussed in greater detail. Author (GRA)

N78-17416# State Univ. of New York, Buffalo. Lab. for Power and Environmental Studies.
LASER INDUCED THERMOELASTIC RESPONSE OF CIRCULAR PLATES Interim Report
Herbert Reismann, Dennis Malone, and Peter S. Pawlik Oct. 1977 95 p refs
(Grant AF-AFOSR-2943-76)
(AD-A047489; AFOSR-77-1286TR) Avail: NTIS HC A05/MF A01 CSCL 20/11

A thermo-elastic model of a laser irradiated plate is developed. The model accounts for plate flexure and shear deformation as well as plate stretching. An exact solution in series form is found for the dynamic response of a circular plate clamped at its boundary. The plate is subjected to laser irradiation at its center, and normal to the plate surfaces. Experiments with a Holobeam model 630-Q Nd Laser were conducted to verify the mathematical model. A careful comparison between theory and experiment of transverse plate deflection induced by the Laser shows good agreement. Author (GRA)

N78-17417# Washington Univ., Seattle. Coll. of Engineering.
THE INFLUENCE OF MATERIAL DEFECTS ON DYNAMIC FRACTURE Final Report, Feb. 1974 - Aug. 1977
Ian M. Fyfe and Douglas H. Polonis Nov. 1977 14 p refs
(Grant DAAG29-74-G-0108)
(AD-A047877; ARO-11956.4-MS) Avail: NTIS HC A02/MF A01 CSCL 11/6

An examination of dynamic fracture in iron, low carbon steel and high purity Al-Cu-Mg alloy under biaxial strain conditions showed that in Ferrovac E iron and high purity alloys, dynamic fracture is associated with intergranular failure. In commercial alloys, however, dynamic fracture occurs by void generation at brittle second phase impurity particles, and the subsequent void interconnection. Static and dynamic tests on thin walled cylinders indicate that dynamic pre-straining has a negligible effect on the strain at failure in 6061-T4 aluminum, but reduces the failure strain in copper, the latter result possibly due to the increased yield strength caused by dynamic loading. In specimens dynamically loaded to failure plastic instability occured at the same strain value as that of the static case. Author (GRA)

N78-17418# Naval Research Lab., Washington, D. C. Engineering Materials Div.
SIGNIFICANCE OF WARM PRESTRESS TO CRACK INITIATION DURING THERMAL SHOCK Interim Report
F. J. Loss, R. A. Gray, Jr., and J. R. Hawthorne 29 Sep. 1977 26 p refs
(Contract AT(49-24)-0207)
(AD-A047831; AD-E000067; NARL/NUREG-8165) Avail: NTIS HC A03/MF A01 CSCL 18/10

During a loss of coolant accident (LOCA) followed by operation of the emergency core cooling system, the inside wall of a nuclear pressure vessel is subjected to high thermal stresses that can cause extension of a preexisting flaw. The crack-tip stress intensity factor K(I) may achieve its maximum value early in the transient, but the critical level for crack initiation K(Ic) may not be reached until minutes later, when the loading has decreased from its peak. This phenomemon, termed warm prestress (WPS), can preclude crack extension when K(I) equals or exceeds K(IC). In an experimental program, employing three-point bend specimens, it was demonstrated that warm prestress acts elevate the 'effective' K(Ic) of the material at the crack tip. This elevation is not uniform; it depends on the WPS level, the degree of unloading, and the increment between the temperature of WPS and the failure temperature. However, WPS can result in an effective elevation in K(Ic) to the WPS level, so that shallow cracks are arrested and deeper ones not extended. The experiments also demonstrated that failure never occurs during the unloading portion of the simulated LOCA path. Factoring WPS into an elastic analysis of crack extension during an LOCA results in predicted crack extension of greatly reduced proportions such that complete penetration of the wall does not occur. The experiments show that the phenomenon of warm prestress should be considered in predictions of reactor vessel integrity, and that this phenomenon may form a key element upon which to base assurance of vessel integrity during a LOCA. Author (GRA)

N78-17419# Massachusetts Inst. of Tech., Cambridge. Acoustics and Vibration Lab.
FORMULATION AND NUMERICAL SOLUTION OF THERMO-ELASTIC-PLASTIC AND CREEP PROBLEMS
Mark D. Snyder Jun. 1977 141 p refs
(PB-274044/7; Rept-82448-3) Avail: NTIS HC A07/MF A01 CSCL 20L

The theoretical formulation and finite element numerical implementation of thermoelastic-plastic and creep analysis techniques were presented. Continuum mechanics incremental equations of motion used in the analysis and the finite element discretization were summarized. A detailed theoretical development of the thermoelastic and thermoelastic-plastic and creep material models for both small and large displacement analysis was the assumption underlying each model and the limits of applicability are stated. The step-by-step solution procedure and the details of the implementation of the material models in the computer program ADINA are presented. Some sample analyses are described to show various solution capabilities using the material models. The report concludes with a brief discussion of areas for future research and development. GRA

N78-17236 Indian Inst. of Tech., Madras.
BEAM VIBRATIONS, A REVIEW
Hans Wagner and V. Ramamurti *In* Shock and Vibration Inform.

Center The Shock and Vibration Digest, Vol. 9, No. 9 Sep. 1977 p 17-24 refs (For availability see N78-17233 08-31) Avail: Naval Research Laboratory, Washington, D. C. 20375 SVIC, Code 8404 Annual Rate $40.00 CSCL 20K

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography. For instrumentation see *35 Instrumentation and Photography*.

N78-17420 Stanford Univ., Calif.
THE USE OF DIGITAL SIMULATION MODELS TO PREDICT THE EFFECTS OF VEGETATION COVER CHANGE ON STREAMFLOW AND DOWNSTREAM WATER USE Ph.D. Thesis
Lloyd John Lundeen 1977 218 p
Avail: Univ. Microfilms Order No. 77-25697

The effect that major vegetative change or complete removal of plant cover would have on both the hydrologic behavior of the watershed and on the availability and use of water downstream from the source area watershed was analyzed. The applicability of several computerized simulation models to answer these questions was also tested. Dissert. Abstr.

N78-17421 Colorado Univ., Boulder.
STATISTICAL ANALYSIS OF THE LIQUID WATER DISTRIBUTION IN A HIGH ALTITUDE SNOWPACK Ph.D. Thesis
Thomas Ray Carroll 1977 86 p
Avail: Univ. Microfilms Order No. 77-29901

The formation, movement, storage, and distribution of liquid water in an isothermal snowpack are examined in the framework of an empirically derived computational model. The model incorporates the major heterogeneities within the pack in an attempt to describe the diurnal and seasonal liquid water distribution within a subalpine isothermal snowpack. The model accounts for diffusion or percolation through an assumed homogeneous snow layer and rapid flow through pipes in snow layers and drains in ice lenses. The model also simulates the ponding of liquid water above semipervious layering within the pack. Dissert. Abstr.

N78-17422 Colorado Univ., Boulder.
PREDICTION OF NATURAL SNOWDRIFT ACCUMULATION ON ALPINE RIDGE SITES Ph.D. Thesis
Neil Hjalmar Berg 1977 320 p
Avail: Univ. Microfilms Order No. 77-29899

A set of hypotheses concerning the development of snowdrifts on natural terrain in alpine areas is presented and transformed into a computer simulation model predicting the location and extent of snowdrift accumulation. Locations in the lower atmospheric boundary layer are specified where topographic changes cause flow expansions so that wind speed decreases below that required to keep snow particles in eolian transport. Several zones of flow are described. Eolian snow particle movement is described. Field experimentation at three sites on Niwot Ridge in the Colorado Front Range were undertaken to test the model and to provide additional information on natural snowdrift development. Dissert. Abstr.

N78-17423 Iowa State Univ. of Science and Technology, Ames.
GROUNDWATER FLOW IN DOUBLE POROSITY MEDIA: CARBONATE ROCKS Ph.D. Thesis
Yakup Basmaci 1977 141 p
Avail: Univ. Microfilms Order No. 77-29823

A coupled saturated-unsaturated groundwater flow model through double porosity media is developed. The model assumes fracture and matrix porosity, and considers caves, and large scale solution channels as boundary conditions in carbonate rocks. The continuum approach is used in the development of the flow equation. A quasi-steady state flow between the matrix and the fractures is assumed. A computer program of the mathematical model is developed and tested by using finite difference equations. Three problems are solved. It is concluded that, spring flow from carbonate terranes mainly originates from unsaturated flow through the matrix-fracture system. The matrix acts like a reservoir providing the sustained yield for springs. Dissert. Abstr.

N78-17424* + National Aeronautics and Space Administration, Washington, D. C.
EARTH RESOURCES: A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 14, JULY 1977
Jul. 1977 128 p
(NASA-SP-7041(14)) Avail: NTIS HC E05 CSCL 05B

This bibliography lists 532 reports, articles, and other documents introduced into the NASA scientific and technical information system between April and June 1977. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis. Author

N78-17425 Wisconsin Univ., Milwaukee.
CONCERNING DISTORTION AND BOUNDARY BEHAVIOR UNDER CONFORMAL MAPPING Ph.D. Thesis
Thomas Ernest Gerasch 1977 83 p
Avail: Univ. Microfilms Order No. 77-29607

A study of the quadrilateral is presented. The proofs of the accessibility theorems as well as the proof of a distortion theorem for the quadrilateral were dependent on the method of extremal length. Let D be a simply connected plane domain which is not the whole plane, and let w = f(z) map [the absolute value of z < 1] one-to-one and conformally onto D. The relative distance script l sub D (w sub 1, w sub 2), between two points of D is defined to be the infinum of the Euclidean lengths of the rectifiable arcs lying in D and joining w sub 1 and w sub 2. The completion of this merit space is the sum of D and R, where R is the set of rectifiably accessible boundary points of D. Each accessible boundary point of D corresponds under f to an e sup (i theta), and R corresponds under f to a set of measure 2 pi on [the absolute value of z = 1]. Dissert. Abstr.

N78-17426 Montana State Univ., Bozeman.
A STRUCTURAL THEORY FOR THE DEFORMATION OF SNOW Ph.D. Thesis
William Francis St.Lawrence 1977 155 p
Avail: Univ. Microfilms Order No. 77-29307

An equation to describe the plastic portion of the deformation was developed by considering the relationship between three fundamental variables. These variables are the mean spacing between ice grains, the relative velocity between grain and the fraction of the total number of grains which participate in the deformation process. The mean distance between ice grains was determined by considering stereologically the snow structure. The velocity component was found by observing the relaxation of the snow. To determine the mobility of the ice grains acoustic emission data was used. An equation describing the pattern of acoustic response at constant rates of deformation was derived and applied to a number of tests. Combining the above variables produces a constitutive equation which reflects the actual behavior of the snow. Dissert. Abstr.

N78-17427*# South Dakota State Univ., Brookings. Remote Sensing Inst.
HCMM ENERGY BUDGET DATA AS A MODEL INPUT FOR ASSESSING REGIONS OF HIGH POTENTIAL GROUNDWATER POLLUTION Quarterly Progress Report, Oct. - Dec. 1977
Donald G. Moore, Principal Investigator and J. Heilman Dec. 1977 4 p ERTS

(Contract NAS5-24206)
(E78-10054; NASA-CR-155548; QPR-2) Avail: NTIS HC A02/MF A01 CSCL 08H

There are no author-identified significant results in this report.

N78-17428*# Pennsylvania State Univ., University Park. Dept. of Meteorology.
APPLICATIONS OF HCMM SATELLITE DATA TO THE STUDY OF URBAN HEATING PATTERNS Quarterly Report
Toby N. Carlson, Principal Investigator 1 Mar. 1978 7 p ERTS
(Contract NAS5-24264)
(E78-10055; NASA-CR-155549; QR-1) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N78-17429*# Science Univ. of Tokyo (Japan).
INVESTIGATION OF ENVIRONMENTAL CHANGE PATTERN IN JAPAN Final Report
Takakazu Maruyasu, Principal Investigator Nov. 1977 180 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS
(E78-10056; NASA-CR-155550) Avail: NTIS HC A09/MF A01 CSCL 04B

The author has identified the following significant results. In the Plains of Tokachi, where the scale of agricultural field was comparatively large in Japan, LANDSAT data with its accuracy have proved to be useful enough to observe the actual condition of agricultural land use and changes more accurately than present methods. Species and ages of grasses in pasture were identified and soils were classified into several types. The actual land cover and ecological environment were remarkably changeable at the rapidly industrialized area by the urbanization in the flat plane and also by the forest works and road construction in the mountainous area. The practical use of the recognition results was proved as the base map of the field survey or the retouching work of the vegetation and land use. There was a 10% cut in cost, labor, and time. Vegetation cover in Tokyo districts was estimated by both the multiregression model and the parametric model. Multicorrelation coefficient between observed value and estimated value was 0.87 and standard deviation was + or - 15%. Vegetation cover in Tokyo was mapped into five levels with equal intervals of 20%.

N78-17430*# Geological Survey, Reston, Va. Water Resources Div.
APPLICATION OF REMOTELY-SENSED LAND USE INFORMATION TO IMPROVE ESTIMATES OF STREAMFLOW CHARACTERISTICS, VOLUME 8 Final Report
Edward J. Pluhowski, Principal Investigator Aug. 1977 84 p refs ERTS
(NASA Order S-70243-AG)
(E78-10057; NASA-CR-155551) Avail: NTIS HC A05/MF A01 CSCL 08H

The author has identified the following significant results. Land use data derived from high altitude photography and satellite imagery are presented for 49 basins in Delaware, and eastern Maryland and Virginia. Applying multiple regression techniques to a network of gaging stations monitoring runoff from 39 of the basins, it was demonstrated that land use data from high altitude photography provided an effective means of significantly improving estimates of stream flow. Forty stream flow characteristic equations for incorporating remotely sensed land use information were compared with a control set of equations, using map derived land cover. Significant improvement was detected in six equations where level 1 data were added and five equations were improved significantly using land use data derived from LANDSAT imagery. Significant losses in accuracy due to the use of remotely sensed land use information were detected only in estimates of flood peaks.

N78-17431*# Geological Survey, Iowa City, Iowa.
LAND CLASSIFICATION OF SOUTH-CENTRAL IOWA FROM COMPUTER ENHANCED IMAGES Final Report
James R. Lucas (EROS Data Center, Sioux Falls, S. D.), James V. Taranik (EROS Data Center, Sioux Falls, S. D.), and Frederic C. Billingsley, Principal Investigators (JPL) Jul. 1977 288 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS
(Contract NAS5-20832)
(E78-10058; NASA-CR-155552) Avail: NTIS HC A13/MF A01 CSCL 08B

The author has identified the following significant results. Enhanced LANDSAT imagery was most useful for land classification purposes, because these images could be photographically printed at large scales such as 1:63,360. The ability to see individual picture elements was no hindrance as long as general image patterns could be discerned. Low cost photographic processing systems for color printings have proved to be effective in the utilization of computer enhanced LANDSAT products for land classification purposes. The initial investment for this type of system was very low, ranging from $100 to $200 beyond a black and white photo lab. The technical expertise can be acquired from reading a color printing and processing manual.

N78-17432*# Department of Industry, London (England).
ANALYSES OF THE CLOUD CONTENTS OF MULTISPECTRAL IMAGERY FROM LANDSAT 2: MESOSCALE ASSESSMENTS OF CLOUD AND RAINFALL OVER THE BRITISH ISLES Final Report
Eric C. Barrett and Colin K. Grant, Principal Investigators Jun. 1977 133 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS
(E78-10059; NASA-CR-155559) Avail: NTIS HC A07/MF A01 CSCL 04B

The author has identified the following significant results. It was demonstrated that satellites with sufficiently high resolution capability in the visible region of the electromagnetic spectrum could be used to check the accuracy of estimates of total cloud amount assessed subjectively from the ground, and to reveal areas of performance in which corrections should be made. It was also demonstrated that, in middle latitude in summer, cloud shadow may obscure at least half as much again of the land surface covered by an individual LANDSAT frame as the cloud itself. That proportion would increase with latitude and/or time of year towards the winter solstice. Analyses of sample multispectral images for six different categories of clouds in summer revealed marked differences between the reflectance characteristics of cloud fields in the visible/near infrared region of the spectrum.

N78-17433*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
NATIONWIDE FORESTRY APPLICATIONS PROGRAM: TEN-ECOSYSTEM STUDY (TES) SITE 2, WARREN COUNTY, PENNSYLVANIA, SITE EVALUATION Final Report
C. A. Reeves, Principal Investigator Nov. 1977 62 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. EREP
(Contract NAS9-15200)
(E78-10060; NASA-CR-151597; LEC-10565) Avail: NTIS HC A04/MF A01 CSCL 08F

The author has identified the following significant results. It was determined that hardwood in Warren County, Pennsylvania could best be inventoried in May. The acreage estimate was less than 3% different from Forest Service estimates.

N78-17434*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
NATIONWIDE FORESTRY APPLICATIONS PROGRAM. TEN-ECOSYSTEM STUDY (TES) SITE 1, GRAND COUNTY, COLORADO Final Report
R. D. Dillman, Principal Investigator Sep. 1977 54 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. EREP
(Contract NAS9-15200)
(E78-10061; NASA-CR-151598; LEC-10691) Avail: NTIS

HC A04/MF A01 CSCL 08F
There are no author-identified significant results in this report.

N78-17435*# Calspan Corp., Buffalo, N. Y.
IMAGE PROCESSING SYSTEM PERFORMANCE PREDICTION AND PRODUCT QUALITY EVALUATION Final Report
Eric K. Stein and Harry B. Hammill, Principal Investigators Apr. 1976 302 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS
(Contract NAS5-20366)
(E78-10062; NASA-CR-156654; ZE-5185-M-2) Avail: NTIS HC A14/MF A01 CSCL 14E

The author has identified the following significant results. A new technique for image processing system performance prediction and product quality evaluation was developed. It was entirely objective, quantitative, and general, and should prove useful in system design and quality control. The technique and its application to determination of quality control procedures for the Earth Resources Technology Satellite NASA Data Processing Facility are described.

N78-17436*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
NEAR EARTH PHOTOGRAPHS FROM THE APOLLO MISSIONS AND THE APOLLO-SOYUZ TEST PROJECT, PART 1
L. E. Giddings, Principal Investigator Aug. 1977 147 p refs EREP
(Contract NAS9-15200)
(E78-10063; NASA-CR-151585; LEC-11026-Pt-1; JSC-12947-Pt-1) Avail: NTIS HC A07/MF A01 CSCL 14E

There are no author-identified significant results in this report.

N78-17437*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
NEAR EARTH PHOTOGRAPHS FROM THE APOLLO MISSIONS AND THE APOLLO-SOYUZ TEST PROJECT, PART 2
L. E. Giddings, Principal Investigator Aug. 1977 143 p refs EREP
(Contract NAS9-15200)
(E78-10064; NASA-CR-151586; LEE-11026-Pt-2; JSC-12947-Pt-2) Avail: NTIS HC A07/MF A01 CSCL 14E

There are no author-identified significant results in this report.

N78-17438*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
NEAR EARTH PHOTOGRAPHS FROM THE APOLLO MISSIONS AND THE APOLLO-SOYUZ TEST PROJECT, PART 3
L. E. Giddings, Principal Investigator Aug. 1977 142 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. EREP
(Contract NAS9-15200)
(E78-10065; NASA-CR-151587; LEC-11026-Pt-3; JSC-12947-Pt-3) Avail: NTIS HC A07/MF A01 CSCL 14E

There are no author-identified significant results in this report.

N78-17439*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
NEAR EARTH PHOTOGRAPHS FROM THE APOLLO MISSIONS AND THE APOLLO-SOYUZ TEST PROJECT, PART 4
L. E. Giddings, Principal Investigator Aug. 1977 143 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. EREP
(Contract NAS9-15200)
(E78-10066; NASA-CR-151588; LEC-11026-Pt-4; JSC-12947-Pt-4) Avail: NTIS HC A07/MF A01

There are no author-identified significant results in this report.

N78-17440*# Stockholm Univ. (Sweden). Asko Lab.
DYNAMICS AND ENERGY FLOWS IN THE BALTIC ECOSYSTEMS: REMOTE SENSING Final Report
Bengt-Owe Jansson and Bo G. Nygvist, Principal Investigators [1977] 173 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS
(E78-10067; NASA-CR-155567) Avail: NTIS HC A08/MF A01 CSCL 08F

There are no author-identified significant results in this report.

N78-17441*# Delaware Univ., Newark. Center for Remote Sensing.
APPLICATION OF LANDSAT TO THE MANAGEMENT OF DELAWARE'S MARINE AND WETLAND RESOURCES Final Report, Feb. 1976 - Dec. 1977
V. Klemas, R. Rogers, (Bendix Aerospace Systems Div., Ann Arbor, Mich.), D. Bartlett, G. Davis, and W. Philpot Dec. 1977 142 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS
(Contract NAS5-20983)
(E78-10068; NASA-CR-155609) Avail: NTIS CSCL 08C

The author has identified the following significant results. LANDSAT data were found to be the best source of synoptic information on the distribution of horizontal water mass discontinuities (fronts) at different portions of the tidal cycle. Distributions observed were used to improve an oil slick movement prediction model for the Delaware Bay. LANDSAT data were used to monitor the movement and dispersion of industrial acid waste material dumped over the continental shelf. A technique for assessing aqueous sediment concentration with limited ground truth was proposed.

N78-17442*# Texas A&M Univ., College Station. Remote Sensing Center.
MICROWAVE REMOTE SENSING AND ITS APPLICATION TO SOIL MOISTURE DETECTION
Richard Wayne Newton, Principal Investigator Jan. 1977 531 p refs EREP
(Contract NAS9-13904)
(E78-10069; NASA-CR-151612; RSC-81) Avail: NTIS HC A23/MF A01 CSCL 08M

The author has identified the following significant results. Experimental measurements were utilized to demonstrate a procedure for estimating soil moisture, using a passive microwave sensor. The investigation showed that 1.4 GHz and 10.6 GHz can be used to estimate the average soil moisture within two depths; however, it appeared that a frequency less than 10.6 GHz would be preferable for the surface measurement. Average soil moisture within two depths would provide information on the slope of the soil moisture gradient near the surface. Measurements showed that a uniform surface roughness similar to flat tilled fields reduced the sensitivity of the microwave emission to soil moisture changes. Assuming that the surface roughness was known, the approximate soil moisture estimation accuracy at 1.4 GHz calculated for a 25% average soil moisture and an 80% degree of confidence, was +3% and -6% for a smooth bare surface, +4% and -5% for a medium rough surface, and +5.5% and -6% for a rough surface.

N78-17443*# Federation of Rocky Mountain States, Inc., Denver, Colo.
A REGIONAL LAND USE SURVEY BASED ON REMOTE SENSING AND OTHER DATA: A REPORT ON A LANDSAT AND COMPUTER MAPPING PROJECT, VOLUME 1 Final Report
George Nez, Principal Investigator and Doug Mutter Apr. 1977 25 p refs ERTS
(Contract NAS5-22338)
(E78-10070; NASA-CR-155610) Avail: NTIS HC A02/MF A01 CSCL 08B

The author has identified the following significant results. New LANDSAT analysis software and linkages with other computer mapping software were developed. Significant results were also achieved in training, communication, and identification

of needs for developing the LANDSAT/computer mapping technologies into operational tools for use by decision makers.

N78-17444*# Federation of Rocky Mountain States, Inc., Denver, Colo.
A REGIONAL LAND USE SURVEY BASED ON REMOTE SENSING AND OTHER DATA: A REPORT ON A LANDSAT AND COMPUTER MAPPING PROJECT, VOLUME 2 Final Report
George Nez, Principal Investigator and Doug Mutter Apr. 1977 119 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS
(Contract NAS5-22338)
(E78-10071; NASA-CR-155611) Avail: NTIS HC A06/MF A01 CSCL 08B

The author has identified the following significant results. The project mapped land use/cover classifications from LANDSAT computer compatible tape data and combined those results with other multisource data via computer mapping/compositing techniques to analyze various land use planning/natural resource management problems. Data were analyzed on 1:24,000 scale maps at 1.1 acre resolution. LANDSAT analysis software and linkages with other computer mapping software were developed. Significant results were also achieved in training, communication, and identification of needs for developing the LANDSAT/computer mapping technologies into operational tools for use by decision makers.

N78-17445*# Federation of Rocky Mountain States, Inc., Denver, Colo.
A REGIONAL LAND USE SURVEY BASED ON REMOTE SENSING AND OTHER DATA: A REPORT ON A LANDSAT AND COMPUTER MAPPING PROJECT, VOLUME 3 Final Report
George Nez, Principal Investigator and Doug Mutter Apr. 1977 766 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS
(Contract NAS5-22338)
(E78-10072; NASA-CR-156676) Avail: NTIS HC A99/MF A01 CSCL 08B

For abstract, see N78-17444.

N78-17446*# Missouri Univ., Columbia.
MAPPING LAND COVER FROM SATELLITE IMAGES: A BASIC, LOW COST APPROACH
C. Dale Elifrits, Terry W. Barney, David J. Barr, and C. J. Johannsen Jan. 1978 24 p refs
(Contract NAS8-31767)
(NASA-CR-2952; M-247) Avail: NTIS HC A02/MF A01 CSCL 08B

Simple, inexpensive methodologies developed for mapping general land cover and land use categories from LANDSAT images are reported. One methodology, a stepwise, interpretive, direct tracing technique was developed through working with university students from different disciplines with no previous experience in satellite image interpretation. The technique results in maps that are very accurate in relation to actual land cover and relative to the small investment in skill, time, and money needed to produce the products. Author

N78-17447*# Missouri Univ., Rolla. Dept. of Mineral, Petroleum, and Geological Engineering.
TECHNIQUES FOR USING DIAZO MATERIALS IN REMOTE SENSOR DATA ANALYSIS
Lee E. Whitebay and Shara Mount Jan. 1978 21 p refs
(Contract NAS8-31767)
(NASA-CR-2953; M-246) Avail: NTIS HC A02/MF A01 CSCL 05B

The use of data derived from LANDSAT is facilitated when special products or computer enhanced images can be analyzed. However, the facilities required to produce and analyze such products prevent many users from taking full advantages of the LANDSAT data. A simple, low-cost method is presented by which users can make their own specially enhanced composite images from the four band black and white LANDSAT images by using the diazo process. The diazo process is described and a detailed procedure for making various color composites, such as color infrared, false natural color, and false color, is provided. The advantages and limitations of the diazo process are discussed. A brief discussion interpretation of diazo composites for land use mapping with some typical examples is included. Author

N78-17448*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT US STANDARD CATALOG Progress Report, 1-30 Nov. 1977
30 Nov. 1977 108 p
(NASA-TM-74998; GSFC/LU-C/011; NTISUB/C/138-011)
Avail: NTIS HC A06/MF A01 CSCL 05B

To provide dissemination of information regarding the availability of LANDSAT imagery, the Image Processing Facility (IPF), located at the Goddard Space Flight Center, publishes a U. S. and Non-U. S. Standard Catalog on a monthly schedule. These catalogs identify imagery which has been processed and input to data files during the referenced month. The U. S. Standard Catalog includes imagery covering the continental United States, Alaska, and Hawaii; the Non-U. S. Catalog identifies all the remaining coverage. Imagery adjacent to the continental U. S. and Alaskan borders will normally appear in the U. S. Standard Catalog. As a supplement to these catalogs, the LANDSAT imagery of one spectral band is available on 16mm microfilm. Author

N78-17449*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT NON-US STANDARD CATALOG Progress Report, 1-30 Nov. 1977
30 Nov. 1977 69 p
(NASA-TM-74867; GSFC/LN-C/011; NTISUB/C/139-011)
Avail: NTIS HC A04/MF A01 CSCL 05B

The Non-U.S. Standard Catalog lists Non-U.S. imagery acquired by LANDSAT 1 and 2 which has been processed and input to the data files during the referenced month. Data, such as data acquired, cloud cover and image quality are given for each scene. The microfilm roll and frame on which the scene may be found is also given. Author

N78-17450*# National Aeronautics and Space Administration, Washington, D. C.
STATISTICAL MAPPING OF SHEET AIQUILE SE-20-9 (NATIONAL MAP) MAKING USE OF ERTS IMAGES
Jose Guillermo Torrez, Carlos E. Brockman, and Alvaro Fernandez Castro Aug. 1977 33 p refs Transl. into ENGLISH from Rev. Cartografica (Brazil), no. 26, 1974 p 127-158 Transl. by Transemantics, Inc., Washington, D.C.
(Contract NASw-2792)
(NASA-TM-75039) Avail: NTIS HC A03/MF A01

New possibilities of remote sensing by means of satellites to do research on natural resources are reported. These images make it possible to carry out integrated studies of natural resources in the shortest time possible and with small investments. Various maps and a complete description of each are included. With the use of these satellites, scientists can hopefully plan development projects at the national level. Author

N78-17451# Lockheed Missiles and Space Co., Palo Alto, Calif.
MULTIZONAL PHOTOGRAPHS FROM SPACE
L. A. Vedeshin [1978] 17 p Transl. into ENGLISH from Priroda (USSR), no. 10, 1977 p 93-104
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The use of multizonal space-borne photography was examined as utilized in the U.S.S.R./G.D.R. space program. The photographic apparatus, MKF-6, was developed and tested as part of the Raduga experiment on Soyuz 22. Earth was successfully studied from space using aerial cosmic facilities. Space photographs obtained are of value in extensive studies of the socialist nations national economy. B.L.P.

N78-17452*# National Conference of State Legislatures, Denver, Colo.
STATE RECOMMENDATIONS ON APPROACHES TO LANDSAT Final Report
Sally M. Bay and Peggy Wubker 13 Apr. 1977 34 p refs

(Contract NASw-2995)
Avail: NTIS HC A03/MF A01 CSCL 05B

The feasibility of continuing the LANDSAT program is contingent upon the success of the technology transfer process to state and local governments. The focus of these concerns can be generally expressed in terms of these issue areas: (1) user needs, in terms of awareness, technical capabilities, and training; (2) product availability and pricing; and (3) roles and communication links, in terms of federal and state governments, the private sector, and the universities. The perspective of the states on these issues are classified. Where possible, alternative strategies for accomplishing the satellite technology transfer for effective state implementation are suggested. Those suggestions are based on the recommendations offered by the state and local user community. Author

N78-17453# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Mobility and Environmental Systems Lab.
AN AUTOMATED PROCEDURE FOR SLOPE MAP CONSTRUCTION. VOLUME 1: DESCRIPTION AND INSTRUCTIONS FOR USE OF THE AUTOMATED PROCEDURE Final Report, 1 Jun. 1975 - 30 Jun. 1976
Horton Struve Oct. 1977 105 p refs
(DA Proj. 1E8-64803-M-730)
(AD-A047794; AEWES-TR-M-77-3-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 09/2

An automated procedure for constructing slope maps was developed and demonstrated in this study. The procedure consists of three sequential parts: (1) input of surface elevation values by means of a matrix of elevation values referred to as an elevation grid array, (2) calculation of slope magnitudes and directions by the computer program SLOPEMAP, and (3) construction of slope maps using various SLOPEMAP output products. The form of input elevation data selected for use by SLOPEMAP to be prepared in advance of program execution is an orthogonal two-dimensional matrix, each element of which is the elevation of the topographic surface at that matrix (or grid) point. At run time, SLOPEMAP inputs these elevation values and calculates the slope magnitude and direction of each input grid point by employing approximation methods that use the elevation values of the grid point in question and its nearest and next nearest neighbors. Then, depending on the selected user options, the calculations are recorded or displayed in one or more of the following forms: (1) printer swath dumps, (2) magnetic tapes, (3) punched cards, and/or (4) drum or cathode ray tube (CRT) graphic plots that delineate slope classes selected by the user. GRA

N78-17454# Centre National d'Etudes Spatiales, Toulouse (France).
FIRST TESTS ON DIRECT MEASUREMENT OF A LIQUID LEAK [PREMIERS ESSAIS D'UNE MESURE DIRECTE D'UNE FUITE LIQUIDE]
Luc Marechal Apr. 1977 31 p refs In FRENCH; ENGLISH summary
(CNES-NT-72) Avail: NTIS HC A03/MF A01

An apparatus allowing measurement of liquid leaks by using the apparent compressibility of the apparatus plus liquid is described. First results observed with water and hydrazine leaks corresponding to gas leaks of different values and types are presented. The phenomena of systematic and gradual blocking of the liquid leaks is discussed. Author (ESA)

N78-17455# Netherlands Interdepartmental Working Group on the Application of Remote Sensing, Delft.
INVESTIGATION ON THE APPLICATION OF MULTISPECTRAL SCANNING [ONDERZOEK NAAR DE TOEPASSINGSMOGELIJKHEDEN VAN MULTISPECTRALE SCANNING]
N. J. J. Bunnik, W. Verhoef, D. Uenk, H. W. J. VanKasteren, T. A. DeBoer, M. C. Bronsveld, I. S. Zonneveld, P. Faber, J. Luitjes, J. VdToorn et al Mar. 1977 381 p refs In DUTCH Original contains color illustrations
(NIWARS-Publ-44) Avail: NTIS HC A17/MF A01

The airborne multispectral scanning (MSS) technique was investigated with special application to vegetation, geology, and water management. Three test flights were made by CNES/GDTA from May 1975 to March 1976, using a Daedalus DS-1250 ten channel MSS, a Daedalus DS-1230 two channel thermal IR scanner, and a wild RC-8 camera with IRC diapositive emulsion. The MSS data were compared with false color photographs. It was found that because of the large resolving power of MSS, both for the wavelength spectrum and for the intensity of the reflected radiation, very slight vegetation differences can already be detected. For geology, aerial photographs and IR images are thought to be more effective. For water householding purposes, so far investigated only for outer dyke areas, MSS gave appreciably more information than false color photographs. ESA

N78-17456# Geological Survey, Bay Saint Louis, Miss. Gulf Coast Hydroscience Center.
COMPUTATIONS OF RECORDS OF STREAMFLOW AT CONTROL STRUCTURES Final Report
Dannie L. Collins May 1977 66 p refs Revised
(PB-273476/2; USGS/WRD/WRI-77/071; USGS/WRI-77-8-Rev) Avail: NTIS HC A04/MF A01 CSCL 13B

Methods are described to calibrate multipurpose regulating control structures to more accurately control structures to more accurately compute streamflow records on highly-regulated streams. Hydraulic theory, is described for five different types of flow control. The instrumentation package and computer programs necessary to collect and process the field data are discussed briefly. GRA

N78-17457# Lockheed Electronics Co., Inc., Las Vegas, Nev. Remote Sensing Lab.
GUIDE TO PRESELECTION OF TRAINING SAMPLES AND GROUND TRUTH COLLECTION
Charles E. Tanner Sep. 1977 32 p refs
(Contract EPA-68-03-2153)
(PB-273513/2; EPA-600/7-77-100) Avail: NTIS HC A03/MF A01 CSCL 09B

Preparation for the novice data processing analyst and field personnel is described, using tools and basic concepts used in the processing of multispectral scanner data via an interactive or conventional processing system. The guide includes an explanation of the need for the collection of accurate/inexpensive ground truth and brief descriptions of the various ecosystems that will be encountered in this study. Also, a detailed list of the actual parameters that should be included in a well-designed ground truth form are provided. Sampling schemes from LANDSAT and aircraft multispectral scanner data are also discussed at length along with procedures and recommendations for selecting training samples from photography for use in automatic data processing. GRA

N78-17458# Purdue Univ., Lafayette, Ind. Water Resources Research Center.
SYSTEMATIC DEVELOPMENT OF METHODOLOGIES IN PLANNING URBAN WATER RESOURCES FOR MEDIUM SIZE COMMUNITIES: APPLICATION OF LINEAR SYSTEMS ANALYSIS TO GROUND WATER EVALUATION STUDIES
C. T. Bathals, Ramachandra Rao, and J. A. Spooner Feb. 1977 143 p refs
(Contract DI-14-31-0001-5213)
(PB-273886/2; PWRRC-TR-91; W78-00570; OWRT-C-6106(5213)(2)) Avail: NTIS HC A07/MF A01 CSCL 08H

A generalized linear model was used to analyze groundwater flow in a stream-well-aquifer system. A procedure was developed to predict aquifer response by considering the cause and effect relationships of the groundwater flow system. In this procedure, historical records of pumping rates, groundwater levels and stream stages, and estimated storage coefficients were used as inputs. The utility of this procedure for analysis of regional aquifer systems was demonstrated by using both field and hypothetical data and satisfactory results were obtained. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N78-17459 Florida Univ., Gainesville.
TEMPORAL AND SPATIAL TEMPERATURE VARIATIONS IN UNHEATED AND SOLARLY HEATED SWIMMING POOLS Ph.D. Thesis
John Theodorou Triandafyllis 1977 253 p
Avail: Univ. Microfilms Order No. 77-25960

The spatial water temperature profile and the time history of the bulk water temperature in an unheated swimming pool and in a swimming pool which is heated by solar flat plate collectors was determined analytically and experimentally. The water temperatures were measured in two identical circular swimming pools. One pool was kept uncovered and was unheated by any external means. The other pool was covered with various transparent plastic covers, and it was heated by flat plate collectors. Measurements in both pools were taken for a period of twelve months. The experimental data were compared and were found to be in excellent agreement with the water temperatures as were calculated by various mathematical models. Dissert. Abstr.

N78-17460* National Aeronautics and Space Administration. Pasadena Office, Calif.
LOW COST SOLAR ENERGY COLLECTION SYSTEM Patent
Charles G. Miller (JPL) and James B. Stephans, inventors (to NASA) (JPL) Issued 27 Dec. 1977 26 p Filed 24 Jul. 1975 Supersedes N75-28519 (13 - 19, p 2406) Sponsored by NASA
(NASA-Case-NPO-13579-1; US-Patent-4,065,053; US-Patent-Appl-SN-598969; US-Patent-Class-237-1A; US-Patent-Class-60-641; US-Patent-Class-62-4; US-Patent-Class-126-271; US-Patent-Class-126-263; US-Patent-Class-165-2) Avail: US Patent Office CSCL 10A

A fixed, linear, ground-based primary reflector having an extended, curved sawtooth contoured surface covered with a metallized polymeric reflecting material, reflected solar energy to a movably supported collector that was kept at the concentrated line focus of the reflector primary. Efficient utilization leading to high temperatures from the reflected solar energy was obtained by cylindrical shaped secondary reflectors that directed off-angle energy to the absorber pipe.
Official Gazette of the U.S. Patent Office

N78-17461 Maryland Univ., College Park.
AN ELLIPSOMETRIC STUDY OF OXIDE FILM FORMATION ON ZINC ELECTRODES Ph.D. Thesis
Carl Ernest Mueller 1977 215 p
Avail: Univ. Microfilms Order No. 77-29137

A combination of experimental techniques to investigate and compare the growth kinetics, structure, composition and growth mechanism of oxide films on zinc electrodes prepared by anodizations in aqueous solutions of potassium hydroxide and in oxygen in the form of a glow discharge plasma. Electrical measurements and ellipsometry were used to monitor and study the oxide films as they were produced. The effect of electrolyte concentration and linear voltage scan rate on respective potentiostatic-polarization (i-V) curves was determined. The limiting current and corresponding passivation potential was determined for each case along with the passivating current. In addition, visual observations concerning the nature and color of the various films formed on the electrode surface were made and correlated with the form of the i-V curves recorded.
Dissert. Abstr.

N78-17462*# General Electric Co., Philadelphia, Pa.
DESIGN STUDY OF WIND TURBINES 50 kW TO 3000 kW FOR ELECTRIC UTILITY APPLICATIONS. VOLUME 2: ANALYSIS AND DESIGN Final Report
Dec. 1976 328 p refs
(Contract NAS3-19403)
(NASA-CR-134935; ERDA/NASA-9403-76/2-Vol-2; GE-SD-76SDS4288-Vol-2) Avail: NTIS HC A15/MF A01 CSCL 10A

All possible overall system configurations, operating modes, and subsystem concepts for a wind turbine configuration for cost effective generation of electrical power were evaluated for both technical feasibility and compatibility with utility networks, as well as for economic attractiveness. A design optimization computer code was developed to determine the cost sensitivity of the various design features, and thus establish the configuration and design conditions that would minimize the generated energy costs. The preliminary designs of both a 500 kW unit and a 1500 kW unit operating in a 12 mph and 18 mph median wind speed respectively, were developed. The various design features and components evaluated are described, and the rationale employed to select the final design configuration is given. All pertinent technical performance data and component cost data are included. The costs of all major subassemblies are estimated and the resultant energy costs for both the 500 kW and 1500 kW units are calculated. Author

N78-17463*# General Electric Co., Philadelphia, Pa.
DESIGN STUDY OF WIND TURBINES 50 kW TO 3000 kW FOR ELECTRIC UTILITY APPLICATIONS. VOLUME 3: SUPPLEMENTARY DESIGN AND ANALYSIS TASKS Final Report
Dec. 1976 62 p refs
(Contract NAS3-19403)
(NASA-CR-135121; ERDA/NASA-9403-76/3-Vol-3) Avail: NTIS HC A04/MF A01 CSCL 10A

Additional design and analysis data are provided to supplement the results of the two parallel design study efforts. The key results of the three supplemental tasks investigated are: (1) The velocity duration profile has a significant effect in determining the optimum wind turbine design parameters and the energy generation cost. (2) Modest increases in capacity factor can be achieved with small increases in energy generation costs and capital costs. (3) Reinforced concrete towers that are esthetically attractive can be designed and built at a cost comparable to those for steel truss towers. The approach used, method of analysis, assumptions made, design requirements, and the results for each task are discussed in detail. Author

N78-17464*# Honeywell, Inc., Bloomington, Minn.
SILICON ON CERAMIC PROCESS. SILICON SHEET GROWTH DEVELOPMENT FOR THE LARGE-AREA SILICON SHEET TASK OF THE LOW-COST SILICON SOLAR ARRAY PROJECT Annual Report, 17 Sep. 1976 - 19 Sep. 1977
J. D. Zook, J. D. Heaps, R. B. Maciolek, B. Koepke, C. D. Butter, and S. B. Schuldt 30 Sep. 1977 115 p refs
(Contract NAS7-100)
(NASA-CR-155613; ERDA/JPL-954356-77/3; AR-2) Avail: NTIS HC A06/MF A01 CSCL 10A

The technical and economic feasibility of producing solar-cell-quality sheet silicon was investigated. The sheets were made by coating one surface of carbonized ceramic substrates with a thin layer of large-grain polycrystalline silicon from the melt. Significant progress was made in all areas of the program.
Author

N78-17465*# General Electric Co., Philadelphia, Pa. Space Div.
CONCEPTUAL APPROACH STUDY OF A 200 WATT PER KILOGRAM SOLAR ARRAY, PHASE 1 Final Report
G. J. Rayl, K. M. Speight, and R. W. Stanhouse 31 Aug. 1977 209 p refs
(Contracts NAS7-100; JPL-954393)
(NASA-CR-155614; DOC-77SDS4207) Avail: NTIS HC A10/MF A01 CSCL 10A

Two alternative designs were studied; one a retractable rollout design and the other a nonretractable foldout configuration. An end of life (EOL) power for either design of 0.79 beginning of

life (BOL) is predicted based on one solar flare during a 3 year interplanetary mission. Both array configurations incorporate the features of flexible substrates and cover sheets. A power capacity of 10 kilowatt is achieved in a blanket area of 76 sq m with an area utilization factor of 0.8. A single array consists of two identical solar cell blankets deployed concurrently by a single, coilable longeron boom. An out of plane angle of 8.25 deg is maintained between the two blankets so that the inherent inplane stiffness of the blankets may be used to obtain out of plane stiffness. This V-stiffened design results in a 67% reduction in the stiffness requirement for the boom. Since boom mass scales with stiffness, a lower requirement on boom stiffness results in a lower mass for the boom. These solar arrays are designed to be compatible with the shuttle launch environment and shuttle cargo bay size limitations. Author

N78-17466*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
WIND TURBINE GENERATOR ROTOR BLADE CONCEPTS WITH LOW COST POTENTIAL
T. L. Sullivan, T. P. Cahill, D. G. Griffee, Jr. (United Technologies Corp., Windsor Locks, Conn.), and H. W. Gewehr (Karman Aerospace Corp.) Dec. 1977 38 p refs To be Presented at the 23rd Natl. SAMPE Symp., Anaheim, Calif., 2-4 May 1978 (Contract E(49-26)-1028)
(NASA-TM-73835; DOE/NASA-1028-77/13; E-9422) Avail: NTIS HC A03/MF A01 CSCL 10A

Four processes for producing blades are examined. Two use filament winding techniques and two involve filling a mold or form to produce all or part of a blade. The processes are described and a comparison is made of cost, material properties, design and free vibration characteristics. Conclusions are made regarding the feasibility of each process to produce low cost, structurally adequate blades. Author

N78-17467*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SYNCHRONIZATION OF THE DOE/NASA 100-KILOWATT WIND TURBINE GENERATOR WITH A LARGE UTILITY NETWORK
Leonard J. Gilbert Dec. 1977 19 p refs
(Contract E(49-26)-1028)
(NASA-TM-73861; E-9450; DOE/NASA/1028/77/10) Avail: NTIS HC A02/MF A01 CSCL 10A

The DOE/NASA 100 kilowatt wind turbine generator system was synchronized with a large utility network. The system equipments and procedures associated with the synchronization process were described. Time history traces of typical synchronizations were presented indicating that power and current transients resulting from the synchronizing procedure are limited to acceptable magnitudes. Author

N78-17468*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD OF CONSTRUCTION OF A MULTI-CELL SOLAR ARRAY Patent Application
Donald E. Routh, Ben R. Hollis, and William R. Feltner, inventors (to NASA) Filed 23 Dec. 1977 9 p
(NASA-Case-MFS-23540-1; US-Patent-Appl-SN-863773) Avail: NTIS HC A02/MF A01 CSCL 10A

A method of construction of photovoltaic devices, particularly of multi-cell photovoltaic devices used to form solar cell arrays, was delineated. The first step is to effect in a top surface region of substrate, a semiconductive layer by the diffusion of an impurity into the top surface region. Next, by photolithography and etching, the base region is divided into a plurality of base regions, and as separated, upper active surface regions are created in the top surface region of the base regions by diffusion of the opposite polarity type to that employed in the creation of base regions. Metal contacts are then formed which interconnect between the upper active region of one cell and the lower base region of the adjoining cell. In this manner, the cells are connected in series to make their voltages additive. NASA

N78-17469*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STATUS OF THE DOE (STOR)-SPONSORED NATIONAL PROGRAM ON HYDROGEN PRODUCTION FROM WATER VIA THERMOCHEMICAL CYCLES
C. E. Baker 1977 16 p refs Presented at the Miami Intern. Conf. on Alternative Energy Sources, Miami Beach, Fla., 5-7 Dec. 1977; sponsored by Dept. of Energy and Miami Univ.
(NASA-TM-78825; E-9529) Avail: NTIS HC A02/MF A01 CSCL 07D

The program structure is presented. The activities of the thermochemical cycles program are grouped according to the following categories: (1) specific cycle development, (2) support research and technology, (3) cycle evaluation. Specific objectives and status of on-going activities are discussed. Chemical reaction series for the production of hydrogen are presented. Efficiency and economic evaluations are also discussed. G.Y.

N78-17470*# Wyle Labs., Inc., Huntsville, Ala. Solar Energy Systems Div.
PERFORMANCE EVALUATION OF TWO BLACK NICKEL AND TWO BLACK CHROME SOLAR COLLECTORS
R. Losey DOE Nov. 1977 21 p refs Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-150497; WYLE-TR-531-3-Rev-A) Avail: NTIS HC A02/MF A01 CSCL 10A

The test program was based on the evaluation of four unique solar collectors described below: (1) black nickel collector surface with a desiccant drying bed, (2) black nickel collector surface without a desiccant drying bed, (3) black chrome collector surface with a desiccant drying bed, and (4) black chrome collector surface without a desiccant drying bed. The test program included three distinct phases: Initial performance evaluation, natural environmental aging, and post-aging performance evaluation. Results of Phase 3 testing conclusively indicated a higher normalized efficiency for Black Chrome surfaces when compared to Black Nickel. Author

N78-17471*# Wyle Labs., Inc., Huntsville, Ala.
MSFC HOT AIR COLLECTORS. PHASE 1: TEST REPORT
R. Losey DOE Nov. 1977 15 p Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-150495; WYLE-TR-531-1-Rev-A) Avail: NTIS HC A02/MF A01 CSCL 10A

A development test program of 3 hot air flat plate solar collectors is described in detail. The pressure drop versus flow rate performance characteristics for these collectors, mounted in series, was determined under 14 different test conditions each of which was characterized by a unique combination of inlet air temperature and air flow rate. Characteristics of inlet, exit and transfer ducts of these collectors were also determined during this testing. The test results indicate that significant pressure drop occurs at air flow rates greater than 150 standard cubic feet per minute and this drop is not heavily dependent upon inlet air temperature; and inlet, exit and transfer duct characteristics differ sufficiently to suggest that system performance may be enhanced through careful design of each type of duct individually. Author

N78-17472*# Wyle Labs., Inc., Huntsville, Ala.
THERMAL PERFORMANCE OF HONEYWELL DOUBLE COVERED LIQUID SOLAR COLLECTOR
R. Losey DOE Nov. 1977 22 p refs Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-150505; WYLE-TR-531-04) Avail: NTIS HC A02/MF A01 CSCL 10A

The test procedures and results obtained during an evaluation test program to determine the outdoor performance characteristics of the Honeywell liquid solar collector are presented. The program was based on the thermal evaluation of a Honeywell double covered liquid solar collector. Initial plans included the simultaneous testing of a single covered Honeywell collector. During the initial testing, the single covered collector failed due to leakage; thus, testing continued on the double covered collector only. To better define the operating characteristics of the collector, several additional data points were obtained beyond those requested. Author

N78-17473*# Wyle Labs., Inc., Huntsville, Ala.
VERIFICATION TEST OF THE MSFC SOLAR SIMULATOR USING A HONEYWELL DOUBLE-COVERED LIQUID SOLAR COLLECTOR

K. Shih DOE Nov. 1977 17 p Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-150507; WYLE-TR-531-06) Avail: NTIS HC A02/MF A01 CSCL 10A

Additional verification data to support the utilization of the MSFC Solar Simulator for testing solar collectors was obtained. The Honeywell double-covered liquid solar collector number 2 for which thermal performance data under natural outdoor conditions had been previously obtained was installed on the Solar Simulator and subjected to a series of eight tests under various conditions of wind flow rate. Although these test conditions were not absolutely identical to those of the outdoor tests, they are considered to be sufficiently representative to provide a basis for an accurate comparative analysis of the data recorded for both test programs. Author

N78-17474*# Wyle Labs., Inc., Huntsville, Ala.
INDOOR TEST FOR THERMAL PERFORMANCE EVALUATION OF LIBBEY-OWENS-FORD SOLAR COLLECTOR
K. Shih DOE Nov. 1977 28 p Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-150508; WYLE-TR-531-07-Rev-A) Avail: NTIS HC A03/MF A01 CSCL 10A

The thermal performance of a flat plate solar collector that uses liquid as the heat transfer medium was investigated under simulated conditions. The test conditions and thermal performance data obtained during the tests are presented in tabular form, as well as in graphs. Data obtained from a time constant test and incident angle modifier test, conducted to determine transient effect and the incident angle effect on the collector, are included. Author

N78-17475*# Southern Univ., Baton Rouge, La. Dept. of Mechanical Engineering.
INHIBITOR ANALYSIS FOR A SOLAR HEATING AND COOLING SYSTEM
John H. Tabony DOE 1 Jun. 1977 25 p Prepared for DOE
(Grant NsG-8025)
(NASA-CR-150513) Avail: NTIS HC A02/MF A01 CSCL 10A

A study of potential corrosion inhibitors for the NASA solar heating and cooling system which uses aluminum solar panels is provided. Research consisted of testing using a dynamic corrosion system, along with an economic analysis of proposed corrosion inhibitors. Very good progress was made in finding a suitable inhibitor for the system. Author

N78-17476*# National Aeronautics and Space Administration, Washington, D. C.
NASA TECH HOUSE
Dec. 1977 20 p Original contains color illustrations
(NASA-EP-149) Avail: NTIS MF A01; SOD HC $1.10 CSCL 10A

The NASA Technology Utilization House, called Tech House, was designed and constructed at NASA's Langley Research Center in Hampton, Virginia, to demonstrate new technology that is available or will be available in the next several years and how the application of aerospace technology could help advance the homebuilding industry. Solar energy use, energy and water conservation, safety, security, and cost were major considerations in adapting the aerospace technology to the construction of Tech House. Author

N78-17477*# Alabama Univ., University. Dept. of Physics and Astronomy.
DEVELOPMENT OF SURFACES OPTICALLY SUITABLE FOR FLAT SOLAR PANELS Quarterly Progress Report, 16 Aug. - 16 Nov. 1977
Donald DeSmet, Andrew Jason, and Albert Parr 16 Nov. 1977 29 p refs
(Contract NAS8-32481)
(NASA-CR-150539; QPR-2) Avail: NTIS HC A03/MF A01 CSCL 10A

Innovations in reflectometry techniques are described; and the development of an absorbing selective coating is discussed along with details of surface properties. Conclusions as to the parameterization desired for practical applications of selective surfaces are provided. Author

N78-17478*# Wyle Labs., Inc., Huntsville, Ala. Solar Energy Systems Div.
THERMAL PERFORMANCE EVALUATION OF SOLAR ENERGY PRODUCTS COMPANY (SEPCO) 'SOLORON' COLLECTOR TESTED OUTDOORS
J. Chiou, Sr. DOE Nov. 1977 91 p refs
(Contract NAS8-32036)
(NASA-CR-150509; WYLE-TR-531-08-Rev-B) Avail: NTIS HC A05/MF A01 CSCL 10A

The test article, Model EF-212, Serial Nr. 002, is a single glazed collector with a nonselective absorber plate, using flowing air as the heat transfer medium. The absorber plate and box frame are aluminum and the insulation is one inch isocyanurate foam board with thermal conductivity of 0.11 (BTU/sq ft Hr0/ft.) The tests included the following. (1) time constant test, (2) collector efficiency test, (3) collector stagnation test, (4) incident angle modifier test, (5) load test, (6) weathering test, and (7) absorber plate optical properties test. The results of these tests are tabulated, graphed, or otherwise recorded. Author

N78-17479*# Life Sciences Engineering, Morrison, Colo.
COLLATION OF QUARTERLY REPORTS ON AIR FLAT PLATE COLLECTORS
DOE 31 Oct. 1977 109 p Prepared for DOE
(Contract NAS8-32261)
(NASA-CR-150514) Avail: NTIS HC A06/MF A01 CSCL 10A

The solar 2 air flat plate collectors are described. The development and fabrication of a prototype air flat plate collector subsystem containing 320 square feet of collector area are described. Three instrumented panels were completely assembled with glazing and insulation. Manufacture of the last seven prototype collectors was completed in October 1977. Author

N78-17480*# Wyle Labs., Inc., Huntsville, Ala.
COMPARISON OF SOLAR SYSTEM MEASURED DATA FOR VARIOUS SAMPLE RATES
J. Chiou, Sr. DOE Nov. 1977 30 p refs Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-150496; WYLE-TR-531-02) Avail: NTIS HC A03/MF A01 CSCL 10A

The results of solar house data for sample rates of 50, 100, 250, 300, and 600 seconds were compared. The data considered for summer days were the heat incident on the collectors, the heat used by the air conditioner generator, and the heat used by the auxiliary heater. For winter days, the heat incident, the heat collected and the heat used by the heat exchanger were computed. These data were compared for different weather days such as clear days, partly cloudy days, cloudy days, and very cloudy days. Also, data for the integration of all these weather days were compared. The precentage differences for these data, using 50 second sample rate as a base, are also presented. Author

N78-17481*# Wyle Labs., Inc., Huntsville, Ala.
INDOOR TEST FOR THERMAL PERFORMANCE EVALUATION OF LENOX-HONEYWELL SOLAR COLLECTOR
Ken Shih DOE Nov. 1977 28 p Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-150510; WYLE-TR-531-09-Rev-A) Avail: NTIS HC A03/MF A01 CSCL 10A

The test procedures used and the test results obtained from an evaluation test program conducted on a double-covered liquid solar collector under simulated conditions are presented. The test article was a flat plate solar collector using liquid as the heat transfer medium. The absorber plate was steel with the copper tubes bonded on the upper surface. The plate was coated with black chrome with an absorptivity factor of .95 and emissivity factor of .12. A time constant test and incident angle modifier test were conducted to determine the transient effect and the incident angle effect on the collector. Author

N78-17482*# Colt, Inc. of Southern California, Rancho Mirage.
PROTOTYPE SOLAR HEATING AND HOT WATER SYSTEMS Quarterly Report
DOE Jan. 1978 26 p refs Prepared for DOE
(Contract NAS8-32242)
(NASA-CR-150525) Avail: NTIS HC A03/MF A01 CSCL 10A

Progress made in the development of a solar hot water and space heating system is described in four quarterly reports. The program schedules, technical status and other program activities from 6 October 1976 through 30 September 1977 are provided. Author

N78-17483*# IBM Federal Systems Div., Huntsville, Ala.
APPLICATION OF SOLAR ENERGY TO AIR CONDITIONING SYSTEMS
Jonathon M. Nash and Andrew J. Harstad Nov. 1976 82 p refs Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-150532; IBM-76W-0122) Avail: NTIS HC A05/MF A01 CSCL 10A

The results of a survey of solar energy system applications of air conditioning are summarized. Techniques discussed are both solar powered (absorption cycle and the heat engine/Rankine cycle) and solar related (heat pump). Brief descriptions of the physical implications of various air conditioning techniques, discussions of status, proposed technological improvements, methods of utilization and simulation models are presented, along with an extensive bibliography of related literature. Author

N78-17484*# IBM Federal Systems Div., Huntsville, Ala.
SIMS PROTOTYPE SYSTEM 1: DESIGN DATA BROCHURE
Jan. 1978 69 p refs Revised Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-150534; IBM-7933447) Avail: NTIS HC A04/MF A01 CSCL 10A

A prototype solar heating and hot water system using air as the collector fluid and a pebble bed for heat storage was designed for installation into a single family dwelling. The system, subsystem, and installation requirements are described. System operation and performance are discussed, and procedures for sizing the system to a specific site are presented. Author

N78-17485*# RHO Sigma, Inc., North Hollywood, Calif.
SYSTEM DESIGN AND INSTALLATION FOR RS600 PROGRAMMABLE CONTROL SYSTEM FOR SOLAR HEATING AND COOLING
Jan. 1978 167 p refs Prepared for DOE
(Contract NAS8-32256)
(NASA-CR-150535) Avail: NTIS HC A08/MF A01 CSCL 10A

Procedures for installing, operating, and maintaining a programmable control system which utilizes a F8 microprocessor to perform all timing, control, and calculation functions in order to customize system performance to meet individual requirements for solar heating, combined heating and cooling, and/or hot water systems are described. The manual discusses user configuration and options, displays, theory of operation, trouble-shooting procedures, and warranty and assistance. Wiring lists, parts lists, drawings, and diagrams are included. A.R.H.

N78-17486*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TECHNICAL AND ECONOMIC FEASIBILITY STUDY OF SOLAR/FOSSIL HYBRID POWER SYSTEMS
Harvey S. Bloomfield and James E. Calogeras Dec. 1977 70 p refs
(NASA-TM-73820; E-9409) Avail: NTIS HC A04/MF A01 CSCL 10B

Results show that new hybrid systems utilizing fossil fuel augmentation of solar energy can provide significant capital and energy cost benefits when compared with solar thermal systems requiring thermal storage. These benefits accrue from a reduction of solar collection area that results from both the use of highly efficient gas and combined cycle energy conversion subsystems and elimination of the requirement for long-term energy storage subsystems. Technical feasibility and fuel savings benefits of solar hybrid retrofit to existing fossil-fired, gas and vapor cycle powerplants were confirmed; however, economic viability of steam cycle retrofit was found to be dependent on the thermodynamic and operational characteristics of the existing powerplant. Author

N78-17487# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
NET ENERGY ANALYSIS MODEL FOR THE EVALUATION OF A SOLAR HEATING, VENTILATION AND AIR CONDITIONING SYSTEM M.S. Thesis
Matt A. Christ and Michael F. Hrapla Sep. 1977 137 p refs
(AD-A047433; AFIT-LSSR-32-77B) Avail: NTIS HC A07/MF A01 CSCL 10/2

This research develops a feasible net energy analysis model from current net energy theory. The net energy model's purpose is to be utilized as an evaluation tool. Net energy analysis is based on the net energy model. Net energy analysis concerns itself with evaluating any system by its performance and interrelationship with the total environment in which the system operates. The model developed specifically addresses a heating, ventilation and air conditioning (HVAC) system. The net energy model was applied to two types of HVAC systems: one powered with conventional fuel sources and one powered with solar energy utilizing a conventional fuel back-up system. The model provided a realistic representation of both HVAC systems. An analysis was conducted on the two systems using data for a base exchange facility at Randolph AFB. The analysis included the use of three net energy analysis measures: net energy, yield ratio, and investment ratio. The results from the net energy analysis were compared to an economic analysis previously conducted to identify differences between the two evaluation methods. Author (GRA)

N78-17488# Naval Undersea Center, San Diego, Calif.
DEVELOPMENT OF LITHIUM INORGANIC ELECTROLYTE BATTERIES FOR NAVY APPLICATIONS Research and Development Report, Jul. 1974 - Feb. 1977
J. F. McCartney, W. H. Shipman, C. R. Gunderson, and C. W. Koehler Feb. 1977 109 p refs
(AD-A047658; NUC-TP-564) Avail: NTIS HC A06/MF A01 CSCL 10/3

The Naval Undersea Center (NUC) has completed an extensive test program of lithium-thionyl chloride ($SOCl_2$) cells of both the high-rate and low-rate configurations. Several deficiencies of earlier cells were corrected by modifying cell hardware design and the addition of chemical additives to the electrolyte for improved safety. As a result of this program, the improved cells are now being used, with complete success, in numerous ocean-oriented applications. Now that many of the problems and hazards of these cells are better understood, lithium-thionyl chloride cells and batteries can be developed for a variety of high- and low-rate applications involving both large- and small-size cells. Author (GRA)

N78-17489# Research Triangle Inst., Research Triangle Park, N. C. Center for the Synthesis and Study of Semiconducting Compounds.
SOLAR CELL DESIGN STUDY Final Report, 1 Apr. 1976 - 2 Jan. 1977
M. F. Lamorte, J. R. Hauser, M. A. Littlejohn, and M. Simons Wright-Patterson AFB, Ohio AFAL Aug. 1977 303 p refs (Contract F33615-76-C-1283)
(AD-A048042; RTI-41U-1259; AFAL-TR-77-74) Avail: NTIS HC A14/MF A01 CSCL 10/2

This report reviews the present state-of-the-art in the technology of selected III-V compounds most applicable to solar cells. Emphasis is placed on those areas of III-V materials technology that can be advanced most effectively in the development of high efficiency solar cells for use in the near-earth space environment. Solar cell configurations evaluated or modeled include homojunctions, heterojunctions, Schottky barriers, graded-structures, and multijunction or cascade designs. Author (GRA)

N78-17490# Federal Energy Administration, Washington, D. C. Office of Specialty Fuels.
ALLOCATION OF PETROLEUM FEEDSTOCKS TO SYNTHETIC NATURAL GAS PLANTS Final Programmatic Environmental Impact Statement
Apr. 1977 1013 p refs
(PB-273098/4; FEA/H-77/369; FES-77/4) Avail: NTIS HC A99/MF A01 CSCL 13B

The FEA proposes to reevaluate and possibly modify its current

program of case-by-case review of applications for the allocation of naphtha and natural gas liquids (NGL) for use in the manufacture of synthetic natural gas (SNG). The FEA's programmatic environmental impact statement presents the impacts in 1980 and 1985 of (1) continuation of the current program, and (2) modification of that program through one of five options ranging from the adoption of a more restrictive policy toward the use of naphtha and NGL for SNG manufacture, to complete removal of controls on these products. GRA

N78-17491# Illinois Univ., Urbana-Champaign. Water Resources Center.

A LINEAR PROGRAMMING MODEL FOR ASSESSING THE REGIONAL IMPACTS OF ENERGY DEVELOPMENT ON WATER RESOURCES Project Completion Report

George Provenzano Jul. 1977 116 p refs

(Contract DI-14-31-0001-4174)

(PB-273022/4; UILU-WRC-77-0126; W77-12633; OWRT-B-092-ILL(4)) Avail: NTIS HC A06/MF A01 CSCL 13B

A multiperiod, multiplant linear programming model of an energy production system and associated water supply components simultaneously appraises alternative expansion strategies and operating schedules for steam electric power generation and coal gasification industries. The model identifies the type, size, location, and sequence of construction of new energy production facilities; and the levels of energy production and transmission that minimize the costs of meeting demands for electricity and gas over a specified future time period. For each minimum-cost expansion strategy that is identified, corresponding information about the amount, location, and sequence with which water will be used in future energy production is determined. GRA

N78-17492# Bureau of Reclamation, Denver, Colo. Engineering and Research Center.

DIGITAL LOAD CONTROL FOR HYDROELECTRIC POWERPLANTS

W. B. Gish Aug. 1977 80 p refs

(PB-274027/2; REC-ERC-77-10) Avail: NTIS HC A05/MF A01 CSCL 10B

A typical load controller for a hydroelectric powerplant using a digital computer was described. Flow charts indicating the necessary timing, interface program interaction, logic, and calculations were included. Notes and suggestions to adapt the algorithm to specific applications were also included. Author

N78-17493# Rutgers - The State Univ., Piscataway, N. J. Dept. of Electrical Engineering.

SILICON SCHOTTKY PHOTOVOLTAIC DIODES FOR SOLAR ENERGY CONVERSION Quarterly Progress Report, 1 Jul. - 30 Sep. 1977

Wayne A. Anderson Oct. 1977 29 p refs

(Grant NSF AER-73-03197)

(PB-274041/3; NSF/RANN/SE/AER73-03197/PR/77) Avail: NTIS HC A03/MF A01 CSCL 10B

Higher efficiency cells were fabricated on single crystal silicon. The Schottky metal showed much promise for future high efficiency cells. It had the advantage of higher optical transmission compared to chromium. Surface state studies continued in an effort to clearly relate open circuit voltage and surface state density. A process for silicon deposition to form thin polycrystalline silicon films on metal substrates is being developed. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N78-17494 Massachusetts Univ., Amherst.

DEVELOPMENT OF AN EMPIRICAL EIGENVECTOR TECHNIQUE AS AN URBAN AIR POLLUTION MODEL Ph.D. Thesis

Richard Robert Knapp 1977 197 p

Avail: Univ. Microfilms Order No. 77-26428

The empirical eigenvector model developed, was based on the statistical analysis of sulfur dioxide measurements taken at ten stations located throughout metropolitan St. Louis, Missouri. The eigenvector technique consisted of transforming the SO2 concentration data set into a small number of eigenvectors which explained most of the total variance of the original data field and resembled the most frequently occurring observed concentration patterns. Associated with each spatial pattern was an eigenvector coefficient whose magnitude and sign varied with time. The eigenvector coefficients were related to time dependent variables by stepwise linear multiple regression to determine the causes of temporal variations of the SO2 concentration data. The eigenvectors were also correlated with space dependent variables. Dissert. Abstr.

N78-17495*# AeroChem Research Labs., Inc., Princeton, N. J.

DEFINITION OF AIR QUALITY MEASUREMENTS FOR MONITORING SPACE SHUTTLE LAUNCHES Final Report

Roger D. Thorpe Jan. 1978 68 p refs

(Contract NAS1-14511)

(NASA-CR-2942; TP-357) Avail: NTIS HC A04/MF A01 CSCL 13B

A description of a recommended air quality monitoring network to characterize the impact on ambient air quality in the Kennedy Space Center (KSC) (area) of space shuttle launch operations is given. Analysis of ground cloud processes and prevalent meteorological conditions indicates that transient HCl depositions can be a cause for concern. The system designed to monitor HCl employs an extensive network of inexpensive detectors combined with a central analysis device. An acid rain network is also recommended. A quantitative measure of projected minimal long-term impact involves the limited monitoring of NOx and particulates. All recommended monitoring is confined ti KSC property. Author

N78-17496*# National Aeronautics and Space Administration, Washington, D. C.

DETERMINATION OF TRACES OF MINERAL OIL IN WATER

Friedrich Scholl and Hannelore Fuchs Sep. 1976 29 p refs Transl. into ENGLISH from Bosch Tech. Ber. (West Germany), v. 2, no. 5, Nov. 1968 p 235-244 Transl. by Transemantics, Inc., Washington, D.C. Original doc. prep. by Bosch (Robert) G.m.b.H., Stuttgart, West Germany

(NASw-2792)

(NASA-TT-F-17230) Avail: NTIS CSCL 13B

Petrol, heavy oil and other mineral oil products can produce contamination of water if stored or handled carelessly. The determination of traces of mineral oil in water is hence very important in practice. The processes for this determination are compared and critically evaluated. An improved infrared-spectroscopic process is described. The limits of error in determining traces of mineral oil of unknown origin and composition in water can be reduced to about plus or minus 10 percent. Author

N78-17497# Rockwell International Corp., Creve Couer, Mo. Air Monitoring Center.

REGIONAL AIR POLLUTION STUDY: OFF-HIGHWAY MOBILE SOURCE EMISSION INVENTORY Final Report

Fred E. Littman and K. M. Isam Oct. 1977 50 p refs

(Contract EPA-68-02-2093)

(PB-273503/3; EPA-600/4-77-041) Avail: NTIS HC A03/MF A01 CSCL 13B

An emission inventory of mobile off-highway sources of air pollution was determined in St. Louis, Missouri. Emissions of HC, CO, NOx, SOx and particulate matter were calculated with the aid of a computer for the 1,989 grid squares comprising the St. Louis region. Source categories included motorcycles; lawn, garden, industrial, construction and farm equipment; and outboard motorboats. Emissions contributed by each category were treated separately. Simplifying assumptions pertaining to area distribution of source populations and usage were used to make calculations possible which generally inadequate data would have otherwise prohibited. The procedures involved in arriving at grid element emissions values are described in detail. GRA

N78-17498# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands).

MODELS FOR THE CALCULATION OF AIR POLLUTION PROPAGATION AND RECOMMENDATIONS FOR THE

VALUES OF THE PARAMETERS IN THE LONG TERM MODEL [MODELLEN VOOR DE BEREKENING VAN DE VERSPREIDING VAN LUCHTVERONTREINIGING INCLUSIEF AANBEVELINGEN VOOR DE WAARDEN VAN PARAMETERS IN HET LANGETERMIJNMODEL]

The Hague Staatsuigeverij Apr. 1976 96 p refs In DUTCH (ISBN-90-12-012716) Avail: NTIS HC A05/MF A01

Air pollution propagation models are presented. Function and purpose of such models are described. The KNMI Gaussian plume model is discussed and the sensitivity of the model for input value variations is indicated. Surface emission sources are dealt with and the combination of point and surface source calculations in a complex source area is described. A sensitivity analysis of the Gauss model for a complex source area is given and the resulting limitations of the model indicated. Calculated values were compared with empirical values and frequency statistics of concentrations and exceeding percentages are discussed. The values for the various parameters to be used in the long term Gaussian plane model are listed. A list of computer programs available and advice on the use of these programs are annexed in loose leaf form. ESA

N78-17499# California State Dept. of Transportation, Sacramento. Transportation Lab.

VARIABLES AFFECTING AIR QUALITY INSTRUMENT OPERATION Interim Report

R. R. Peter, K. O. Pinkerman, and E. C. Shirley Jul. 1977 82 p refs

(Contract DOT-FH-11-7730)

(PB-273472/1; FHWA/RD-77-77; FHWA/CA/TL-7080-77-15) Avail: NTIS HC A05/MF A01 CSCL 14B

An analysis of the monitoring system of a Caltrans air pollution research van is presented. This analysis investigates the effects of several system variables on instrument response, including the length of the sample intake lines, variation in instrument supply voltage van interior temperature, soiling of intake line filters and the retention time of air samples in Teflon bags. Where system variables are found to affect instrument response, regression equations were developed which correct for the effects of these variables. GRA

N78-17500# Industrial Environmental Research Lab., Cincinnati, Ohio.

INDUSTRIAL POLLUTION CONTROL DIVISION REPORTS AND PROJECT ABSTRACTS

James R. Boydston, ed. Oct. 1977 96 p

(PB-273484/6; EPA-600/9-77-030) Avail: NTIS HC A05/MF A01 CSCL 13B

Bibliographic information and abstracts for all reports issued by EPA and its predecessor agencies on the development and demonstration of technology to control pollution from those industries which are assigned to IERL-Cincinnati are given. The major industries included are: nonferrous metals, inorganic chemicals, organic chemicals, food products, pulp, paper and wood products, and metal finishing and fabricating. GRA

N78-17501# Environmental Monitoring and Support Lab., Research Triangle Park, N. C. Field Studies Section.

SULFUR DIOXIDE BUBBLER TEMPERATURE STUDY

Barry E. Martin Aug. 1977 32 p refs

(PB-273504/1; EPA-600/4-77-040) Avail: NTIS HC A03/MF A01 CSCL 14B

A series of temperature controlled studies designed to determine the temperature characteristics of several thermostated systems used to collect sulfur dioxide from the ambient air by the EPA Federal Reference Method are described. GRA

N78-17502# Environmental Monitoring and Support Lab., Research Triangle Park, N. C.

QUALITY ASSURANCE HANDBOOK FOR AIR POLLUTION MEASUREMENT SYSTEMS. VOLUME 2: AMBIENT AIR SPECIFIC METHODS

Darryl J. Von Lehmden and Carl Nelson May 1977 279 p refs

(Contract EPA-68-01-4147)

(PB-273518/1; EPA-600/4-77-027a-Vol-2) Avail: NTIS HC A13/MF A01 CSCL 13B

The production of quality data is discussed and also included are quality assurance guidelines in the areas of: (1) sampling site selection considerations, (2) sampling considerations, (3) data handling and reporting, (4) equivalent methods, and (5) recommended minimum quality assurance program for ambient air monitoring systems. Reference methods for determination of sulfur dioxide and for determination of suspended particulates are presented. GRA

N78-17503# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

INVESTIGATION OF IMPOTENT HYDROXYL RADICAL REACTIONS IN THE PERTURBED TROPOSPHERE Final Report, May 1974 - Jul. 1977

D. D. Davis Oct. 1977 88 p refs

(Grant EPA-R-804629)

(PB-274012/4; EPA-600/3-77-111) Avail: NTIS HC A05/MF A01 CSCL 07D

The flash-photolysis resonance fluorescence technique was used to study the reaction kinetics of hydroxyl radicals with ten aromatic and six olefinic hydrocarbons at 298 K and several diluent gas pressures. Based on extensive data on OH-substituted aromatic hydrocarbon reactions, it was inferred that addition of hydroxyl radicals to the aromatic ring is the dominant reaction in these systems. From these rate constant data, the lifetimes of all these hydrocarbons in the lower troposphere were calculated. GRA

N78-17504# Ford Motor Co., Dearborn, Mich.

EMISSION TESTING AND EVALUATION OF FORD/KOPPERS COKE PUSHING CONTROL SYSTEM, VOLUME 1 Final Report, Dec. 1973 - Aug. 1977

Fred Cooper, Thomas Loch, John Mutchler, and Janet Vecchio Sep. 1978 278 p refs Prepared in cooperation with Clayton Environmental Consultants, Inc., Southfield, Mich.

(Contract EPA-68-02-0630)

(PB-273812/8; EPA-600/2-77-187a) Avail: NTIS HC A13/MF A01 CSCL 07D

The performance of a retrofitted, mobile-hood, high energy scrubber control system, abating coke-side pushing emissions from a 58-oven coke battery was field tested and evaluated. The venturi-scrubber inlet and outlet emission rates are documented, as well as emission factors for filterable and condensable particulate, sulfur dioxide, sulfur trioxide, total sulfur oxides, carbon monoxide, nitrogen oxides, benzene, benzene and homologues, total light hydrocarbons, methane and homologues, and ethylene and homologues. Scrubber performance averaged 99.3% for particulate emissions captured in the hood. GRA

N78-17505# PEDCO-Environmental Specialists, Inc., Cincinnati, Ohio.

OPERATION AND MAINTENANCE OF PARTICULATE CONTROL DEVICES ON COAL-FIRED UTILITY BOILERS Final Report

Michael F. Szabo and Richard W. Gerstle Jul. 1977 384 p refs

(Contract EPA-68-02-2105)

(PB-274104/9; EPA-600/2-77-129) Avail: NTIS HC A17/MF A01 CSCL 07A

The control of fine particulate from coal-fired utility boilers, using electrostatic precipitators (ESPs), wet scrubbers, and fabric filters is discussed. Guidelines are provided to utility personnel, on significant design and cost data correlations based on current design practice for ESPs and actual operating and cost data for wet scrubbers and fabric filters. Fractional efficiency prediction models for ESPs and wet scrubbers are given which allow comparison of capital and operating costs under different coal/boiler application conditions and different levels of fractional efficiency. GRA

N78-17506# Center for the Environment and Man, Inc., Hartford, Conn.

OPTIMUM SITE EXPOSURE CRITERIA FOR SO2 MONITORING Final Report

Robert J. Ball and Gerald E. Anderson Apr. 1977 181 p refs

(Contract EPA-68-02-2045)

(PB-274037/1; EPA-450/3-77-013) Avail: NTIS HC A09/MF A01 CSCL 13B

Site selection procedures were prepared for specific

site types each of which was associated with either a grouping of siting objectives or with an individual objective. Detailed procedures are provided for selecting sites to measure regional mean concentrations, interregional SO2 transport, representative concentrations for areas of various sizes, peak concentrations in urban areas, and emergency episode levels. Recommendations and the rationale for inlet height and orientation, and for minimizing undue influence from nearby sources are presented. Sources of special information and data relevant to selecting specific sites and guidelines for determining locations of sites for satisfying specific objectives are provided in a series of appendices. GRA

N78-17507# Environmental Protection Agency, Philadelphia, Pa.
EFFECTS OF OCEAN DUMPING ACTIVITY, MID-ATLANTIC BIGHT, 1976 Interim Report
Donald W. Lear, Marria L. OMalley, and Susan K. Smith Jul. 1977 186 p refs
(PB-273878/9; EPA-903/9-77-029) Avail: NTIS HC A09/MF A01 CSCL 13B

Ambient concentrations of metals, found in ocean sediments at the City of Philadelphia sewage sludge release site, were derived from statistical comparisons over a 3 year period. Polychlorinated biphenyls were widely distributed in concentrations that may be inimical to marine organisms with indicated cyclical inputs, possibly from the coastal zone. Mortalities of the mahogany clam were indicated at loci in and near the ocean dumping activity. Detailed bathymetry of the impacted area south of the site indicated geomorphic features may affect the aggregation of dumped materials. GRA

N78-17508# Environmental Protection Agency, Research Triangle Park, N.C. Monitoring and Data Analysis Div.
AIR MONITORING STRATEGY FOR STATE IMPLEMENTATION PLANS Final Report
Jun. 1977 241 p refs
(PB-274014/0; EPA-450/2-77-010) Avail: NTIS HC A11/MF A01 CSCL 13B

The air monitoring strategy for State implementation plans developed by the Standing Air Monitoring Work Group (SAMWG) is described. A summary of their review and evaluation of current air monitoring activities is presented. A discussion of SAMWG's findings and their resulting air monitoring strategy for State Implementation plan monitoring is provided. The major topics discussed in the strategy are: (1) ambient monitoring, (2) source monitoring, (3) future monitoring for noncriteria pollutants, (4) quality assurance activities for ambient and source monitoring, (5) analysis and interpretation of air quality information, (6) anticipated impact of the strategy, and (7) implementation of the strategy. GRA

N78-17509# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
GUIDELINES FOR AIR QUALITY MAINTENANCE PLANNING AND ANALYSIS. VOLUME 10: PROCEDURES FOR EVALUATING AIR QUALITY IMPACT OF NEW STATIONARY SOURCES
Laurence J. Budney Oct. 1977 89 p refs Revised
(PB-274087/6; EPA-450/4-77-001-Vol-10-Rev; QAQPS-1.2-029-R-Vol-10-Rev) Avail: NTIS HC A05/MF A01 CSCL 13B

Basic modeling techniques are provided for estimating the air quality impact of new stationary sources. The revision is in a more readily useable format and incorporates changes and additions to the technical approach. Also, a simple screening procedure was added. The techniques are applicable to chemically stable, gaseous or fine particulate pollutants. An important advantage of the technique is that a sophisticated computer is not required. A pocket or desk calculator will generally suffice. GRA

N78-17510# Pacific Environmental Services, Inc., Santa Monica, Calif.
EFFECTS OF STAGE 1 VAPOR RECOVERY REGULATIONS ON SMALL BULK PLANTS AND ON AIR QUALITY IN THE WASHINGTON, D. C., BALTIMORE, MARYLAND, AND HOUSTON/GALVESTON, TEXAS AREAS Final Report
R. J. Bryan, M. M. Yamada, and R. L. Norton Mar. 1977 165 p refs
(Contract EPA-68-01-3156)
(PB-274140/3; EPA-340/1-77-010) Avail: NTIS HC A08/MF A01 CSCL 13B

Bulk plant operations in areas surrounding Baltimore, Md. Washington, D.C., and Houston/Galveston, Tx. were surveyed. For these specific locations data was obtained to: provide an inventory of bulk plants and classify these plants by throughput, describe facilities and vapor recovery equipment at the bulk plants, and dispensed to non-exempt accounts, agriculture accounts and accounts with small tanks. A financial profile of typical bulk plants was also prepared. GRA

N78-17511# PEDCO-Environmental Specialists, Inc., Cincinnati, Ohio.
ENVIRONMENTAL PROTECTION AGENCY NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS
Jun. 1977 153 p refs
(Contract EPA-68-01-4147)
(PB-274043/9; EPA-340/1-77-020) Avail: NTIS HC A08/MF A01 CSCL 13B

A compilation of the Environmental Protection Agency National Emission Standards for Hazardous Air Pollutants (NESHAP) is presented. The manual is intended to serve as a convenient reference and source of current information to those persons who will be working with the NESHAP regulations. The manual includes the full text of the standards as they appear now with all revisions, corrections, and additions where applicable, and the full text of all revisions and other Federal register notices pertaining to the standards. GRA

N78-17512# Transportation Systems Center, Cambridge, Mass.
A COMPARISON OF SIX HIGHWAY AIR POLLUTION DISPERSION MODELS USING SYNTHETIC DATA Final Report, Nov. 1975 - Mar. 1976
Paul J. Downey, Jeffrey D. Garlitz, and Kevin H. Murphy Jun. 1977 192 p refs
(PB-274273/2; DOT-TSC-OST-76-58) Avail: NTIS HC A09/MF A01 CSCL 13B

The performance of six highway air pollution dispersion models was tested with a synthetic data base. The air pollution predictions of the six models were compared in pairs, and various measures of the difference between the predictions of each pair were calculated. A group of three models generating very similar predictions was discovered; these were termed consensus models. GRA

N78-17513# Environmental Research Lab., Johns Island, S. C. Bears Bluff Field Station.
WATER-SOFTENING AND CONDITIONING EQUIPMENT: A POTENTIAL SOURCE OF WATER CONTAMINATION Final Report, 28 Aug. 1976 - 27 Aug. 1977
Allan M. Crane and Anne E. Freeman Sep. 1977 19 p refs
(PB-274083/5; EPA-600/3-77-107) Avail: NTIS HC A02/MF A01 CSCL 13B

Chloroform, trichloroethene, and tetrachloroethene, as well as two unidentified compounds, were adsorbed from contaminated ground water onto anion-cation exchange resins during their regeneration and cleaning at the distributing plant. Contaminants leached into water passed through the resins after distribution resulted in contamination of deionized water supplies of users. Concentrations of chloroform and trichloroethene, greater in filtered water than concentrations observed in contaminated ground water, indicated the ability of resins to concentrate these compounds. GRA

N78-17514# Federal Energy Regulatory Commission, Washington, D. C.
ELECTRIC UTILITIES USE OF FLUE GAS DESULFURIZATION TECHNOLOGY IN THE UNITED STATES
Abdul Q. Dasti Oct. 1977 35 p refs
(PB-274120/5) Avail: NTIS HC A03/MF A01 CSCL 07A

Flue gas desulfurization units in the planning stage, under construction and in operation were identified, according to geographical location. GRA

N78-17515# Environmental Protection Agency, Research Triangle Park, N.C. Monitoring and Data Analysis Div.
AIR QUALITY DATA: 1976 FIRST QUARTER STATISTICS Quarterly Report, Jan. - Mar. 1976
Aug. 1977 121 p
(PB-273441; EPA-450/2-77-014; QR-1) Avail: NTIS HC A06/MF A01 CSCL 13B

A statistical summary report on ambient air quality is provided, submitted to EPA from air monitoring operations of state, local and federal networks in accordance with requirements of the Clean Air Act and EPA regulations for State Implementation Plans. These data represent all ambient air quality data sampled for pollutants that currently have National ambient air quality standards. GRA

N78-17516# Environmental Protection Agency, Research Triangle Park, N.C. Monitoring and Data Analysis Div.
AIR QUALITY DATA: 1976 SECOND QUARTER STATISTICS Quarterly Report, Apr. - Jun. 1976
Aug. 1977 104 p
(PB-273442/4; EPA-450/2-77-015; QR-2) Avail: NTIS HC A06/MF A01 CSCL 13B

For abstract, see N78-17515.

N78-17517# Environmental Protection Agency, Research Triangle Park, N.C. Monitoring and Data Analysis Div.
AIR QUALITY DATA: 1976 THIRD QUARTER STATISTICS Quarterly Report, Jul. - Sep. 1976
Aug. 1977 85 p
(PB-273443/2; EPA-450/2-77-016; QR-3) Avail: NTIS HC A05/MF A01 CSCL 13B

For abstract, see N78-17515.

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N78-17518 Illinois Univ., Urbana-Champaign.
THE EFFECT OF GEOLOGY AND CONSTRUCTION ON BEHAVIOR OF A LARGE, SHALLOW, UNDERGROUND OPENING IN ROCK Ph.D. Thesis
James William Mahar 1977 333 p
Avail: Univ. Microfilms Order No. 77-26710

The Dupont Circle Station rock chamber approximately 80 ft wide and 44 ft high, and overlain by 30 ft of rock cover, was driven through a mica-quartz schist that are cut by eight foliation shear zones and joints combined to form large wedges that tended to drop or slide into the opening. Measured rock movements in the top heading of the opening during station construction were related to the geologic and construction conditions. Because shears, shear zones, and continuous joints were almost always present in the openings, the rock movements were more sensitive to the construction procedures than to the geology. Criteria for detecting serious rock movements and potentially unstable conditions were developed in terms of the depth, magnitude, and time-rate of movements. Dissert. Abstr.

N78-17519 Stanford Univ., Calif.
A STUDY OF STRESS-DEPENDENT VELOCITY VARIATIONS IN SITU Ph.D. Thesis
Donald John Stierman 1977 208 p
Avail: Univ. Microfilms Order No. 77-25734

Velocities of seismic compressional waves are anomalously low in and around a well-bore located in Stone Canyon, San Benito County, California. These low velocities are attributed to the extensive fracturing of rocks along the San Andreas fault. Analysis of geophysical data suggests that saturated macrocracks, are responsible for the 30-50% deficiency in the velocity of P-waves around this well. These macrocracks fail to close in response to confining stress at the depths predicted by laboratory studies. The sensitivity of the rocks to pressure in situ is higher than the sensitivity of laboratory specimens. The investigations provide the bases for using seismic velocities as a means of monitoring changes in stress in situ. Dissert. Abstr.

N78-17520 Washington Univ., Seattle.
INVERSION OF TRAVELTIME DATA FOR SEISMIC VELOCITY STRUCTURE IN THREE DIMENSIONS Ph.D. Thesis
Joyce Chee Wu 1977 80 p
Avail: Univ. Microfilms Order No. 77-26880

A one-step linearized inversion based on the generalized prediction theory of Backus is used to approximate box-car functions for three-dimensional velocity inversion. The resolution and error associated with the estimates are discussed. Only one matrix inversion is necessary to produce averages over volumes of different sizes and shapes. Two tests of the method using synthetically generated data were performed. One model has a bowl-shaped low velocity region in a homogeneous half-space, and the other has a low velocity rectangular box in a region adjacent to a simulated vertical fault of finite depth. The trade-off between resolution and estimate error for each region under estimation can be found by a set of averages over volumes of different sizes. At one end the error is large, while at the other end the solution is over-smoothed in space. The quantity and quality of the particular traveltime data set have important effects on the velocity inversion. Dissert. Abstr.

N78-17521 California Univ., Riverside.
NICKEL ADSORPTION BY DIFFERENT SOIL SEPARATES AND LAYER SILICATES Ph.D. Thesis
Abdalla Sasi Gibali 1977 154 p
Avail: Univ. Microfilms Order No. 77-27122

The partition of Ni between a solid phase of representative soils and layer silicates having surfaces bearing a constant surface charge, and constant surface potentials, and a aqueous phase, using Ni concentrations in solution similar to those found in natural soil-water system was defined. Nickel adsorption experiments were performed using seven soil separates of differing chemical and mineralogical composition, with initial Ni concentration ranging from 118 to 945 micrograms/1. It was found that soils characterized as containing constant potential surfaces adsorbed less Ni at pH's near of less than the zero point of charge than did soils characterized by constant surfaces at the same pH. Generally, Ni adsorption increased as the pH of the equilibrium solution increased. Dissert. Abstr.

N78-17522 Illinois Univ., Urbana-Champaign.
THE GRAVITY WAVE-CRITICAL LEVEL INTERACTION Ph.D. Thesis
David Conrad Fritts 1977 186 p
Avail: Univ. Microfilms Order No. 77-26667

Three models were developed to examine various features of the gravity wave-critical level interaction and some of its possible roles in the dynamics of the atmosphere and the oceans. A linear inviscid steady state model was designed which, though singular at the critical level, illustrates certain important features of the gravity wave-critical level interaction. A linear viscous steady state model was used to examine the effects of dissipation, and a nonlinear viscous time dependent model was developed to evaluate the importance of time dependence and nonlinear effects on the development of the gravity wave-critical level interaction. Results obtained with the three models indicate that a number of effects may be important in correctly modelling the gravity wave-critical level interaction. Dissert. Abstr.

N78-17523 Colorado State Univ., Fort Collins.
FLUCTUATIONS IN THE ATMOSPHERE'S ENERGY CYCLE Ph.D. Thesis
James Patrick McGuirk 1977 227 p
Avail: Univ. Microfilms Order No. 77-28316

The four energy modes of the atmosphere's energy cycle were computed on a daily basis, using nine years of National Meteorological Center gridded height and temperature data to investigate the short-term and interannual variability of the Northern Hemisphere's large scale circulation. Although the amplitude of the interannual variability of each mode is quite large (about 20% of the amplitude of the annual cycle), an analysis of the deviations of the energy mode time series about their respective 9 year average annual cycles indicates that the

fluctuations on time scales of a few weeks or less are at least as important as the interannual fluctuations. Even though the distributions of the daily energy fluctuations about their 9 year means are approximated very closely by normal distributions, it is shown that the time series of the energy modes are not series of random deviations superimposed upon a mean annual cycle. Dissert. Abstr.

N78-17524 Cincinnati Univ., Ohio.
ON POTENTIAL WELL TREATMENT FOR ATMOSPHERIC GRAVITY WAVES Ph.D. Thesis
Luis Kimtiao Yu 1977 73 p
Avail: Univ. Microfilms Order No. 77-29720

Gravity wave propagation through the atmosphere was formally reduced to a multichannel scattering problem with an effective 'potential'. On the first order perturbation, the gravity wave channel was decoupled from the heat conduction channel. For the pure gravity wave channel, the 'potentials' for different exospheric temperatures ranging from 600 K to 2200 K were obtained. The 'potentials' had the following features: the shapes of the 'potentials' for all exospheric temperatures were insensitive to gravity wave periods longer than half an hour; below half an hour, wells appeared to trap gravity waves in regions where the gravity wave period was close to the Brunt-Vaisala period; there were two distinct wells in the models, one at ground level and another at 50 km; these wells exhibited seasonal dependence. Dissert. Abstr.

N78-17525 Colorado Univ., Boulder.
THE EFFECT OF TOPOGRAPHIC WAVELENGTH ON THE WAVE DRAG OF A WAVY PLATEAU IN A STRATIFIED FLOW Ph.D. Thesis
Olayiwola Olorunsola 1977 72 p
Avail: Univ. Microfilms Order No. 77-29957

The two dimensional flow of a steady, inviscid, incompressible but stratified fluid over a sinusoidal topography superimposed on a semi-infinite plateau of finite height in a bounded channel was considered. The effects of the wavelength of the sinusoidal topography on the wave drag and that on the surface wind velocity downstream of the plateau were examined in particular. An appreciable amount of flow intensification for wavelengths between 11 and 30 kilometers was predicted. The wave drag coefficient for a flat plateau was obtained for various air-streams, and the result is compared to that for an equally high plateau with a superimposed sinusoid having the characteristic wavelength which produces the strongest measurable intensification. Dissert. Abstr.

N78-17526 State Univ. of New York, Albany.
THE HEAT CONDUCTION AT THE PLASMAPAUSE AND THE RESPONSE OF THE NEUTRAL ATMOSPHERE DURING THE TIMES OF 6300A (O I) EMISSIONS Ph.D. Thesis
Jarajapu Satyanarayana Prasad 1977 277 p
Avail: Univ. Microfilms Order No. 77-29174

The temporal variations of electron temperatures were closely examined diring the times of mid-latitude red arcs. The data from the planar ion trap experiment on the low altitude satellite, OGO 6 was analyzed to find experimental support for the soft electron flux hypothesis. The correlations made between the magnetospheric light ion densities and the ionospheric electron temperatures revealed that the observed increases of electron temperatures were caused by the heat conducted at the plasma-pause. The structure of the magnetospheric plasmapause was investigated by means of light ion density profiles that were obtained from the data gathered from the OGO 5 spacecraft. Dissert. Abstr.

N78-17527*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
RESEARCH CONCERNING THE GEOPHYSICAL CAUSES AND MEASUREMENT ACCURACIES RELATED TO THE IRREGULARITIES IN THE ROTATION OF THE EARTH Final Report, 11 Dec. 1972 - 10 Oct. 1975
Douglas G. Currie Feb. 1978 73 p refs
(Grant NGR-21-002-390)
(NASA-CR-155732) Avail: NTIS HC A04/MF A01 CSCL 08E

The primary objective of this effort consisted of a detailed study of the history of the motion of the moon. Several analyses were developed which are related to the determination of the effect of various refractive phenomena on the accuracy of measurements made through the earth's atmosphere. Author

N78-17528# Finnish Meteorological Inst., Helsinki.
ATMOSPHERIC ELECTRIC MEASUREMENTS IN FOG FORECASTING
Tapio J. Tuomi and Juha Aysto 1977 34 p refs In FINNISH
(ISBN-951-697-099-0; ISSN-0355-1717; Rept-70) Avail: NTIS HC A03/MF A01 CSCL 04A

The behavior of atmospheric electrical conductivity was studied during and before fog formation. Data collected in Helsinki-Vantaa Airport from April to August 1977 include conductivity, relative humidity and visibility, and, in some cases, the ground temperature. In general, when conductivity decreases by at least 30% and relative humidity rises up to or above 94%, fog is expected. Also, ground temperature may begin to rise before fog onset. However, failures in the forecasting occur, especially with radiation fogs; correct prediction of fog using conductivity and relative humidity is obtained in 75% of the cases. A possible cause of the failures is the site of the conductivity meter, at 1 m height on the wall of a weather station. Author

N78-17529*# National Aeronautics and Space Administration. Pasadena Office, Calif.
SYSTEM FOR NEAR REAL-TIME CRUSTAL DEFORMATION MONITORING Patent Application
Peter F. MacDoran, inventor (to NASA) (JPL) Filed 21 Dec. 1977 21 p
(Contract NAS7-100)
(NASA-Case-NPO-14124-1; US-Patent-Appl-SN-863024) Avail: NTIS HC A02/MF A01 CSCL 08G

Near real-time crustal deformation monitoring can be achieved by independent stations which receive S-band radio signals from an Apollo Lunar Surface Experiment Package (ALSEP). The received signals are time tagged by a digital code or L-band signals from the Global Positioning System (GPS) using synchronized atomic clocks 18 and 20 at the two stations and then transmitted to a cross-correlation station 22 through telephone lines 14 and 16. The time tags permit the phone line delays to be determined in order for any difference in the phone line delays to be compensated before cross correlating the signals. The fringe frequency observation from ALSEP or delay from GPS are obtained by cross correlation and used to estimate base lines for crustal deformation monitoring. The novelty of the invention resides in the use of an artificial radio signal source of narrow bandwidth for transmission over conventional telephone lines. NASA

N78-17530*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RECOVERY OF REFRACTIVITY PROFILES AND PRESSURE AND TEMPERATURE DISTRIBUTIONS IN THE LOWER ATMOSPHERE FROM SATELLITE-TO-SATELLITE RADIO OCCULTATION DATA
Charles W. Murray, Jr. Nov. 1977 65 p refs
(NASA-TM-78020) Avail: NTIS HC A04/MF A01

The feasibility of recovering parameters from one-way range rate between two earth orbiting spacecraft during occultation of the tracking signal by the earth's lower atmosphere. The tracking data is inverted by an integral transformation (Abel transform) to obtain a vertical refractivity profile above the point of closest approach of the ray connecting the satellites. Pressure and temperature distributions can be obtained from values of dry refractivity using the hydrostatic equation and perfect gas law. Two methods are investigated for recovering pressure and temperature parameters. Results show that recovery is much more sensitive to satellite velocity errors than to satellite position errors. An error analysis is performed. An example is given demonstrating recovery of parameters from radio occultation data obtained during satellite-to-satellite tracking of Nimbus 6 by the ATS 6 satellite. Author

N78-17531*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN INFORMATION THEORY APPROACH TO THE DENSITY OF THE EARTH

Michael A. Graber Nov. 1977 38 p refs Submitted for publication
(NASA-TM-78034) Avail: NTIS HC A03/MF A01

Information theory can develop a technique which takes experimentally determined numbers and produces a uniquely specified best density model satisfying those numbers. A model was generated using five numerical parameters: the mass of the earth, its moment of inertia, three zero-node torsional normal modes (L = 2, 8, 26). In order to determine the stability of the solution, six additional densities were generated, in each of which the period of one of the three normal modes was increased or decreased by one standard deviation. The superposition of the seven models is shown. It indicates that current knowledge of the torsional modes is sufficient to specify the density in the upper mantle but that the lower mantle and core will require smaller standard deviations before they can be accurately specified. Author

N78-17532*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STRATOSPHERIC OZONE MEASUREMENT WITH AN INFRARED HETERODYNE SPECTROMETER
Mian M. Abbas (Maryland Univ., College Park), Theodor Kostiuk, Michael J. Mumma, David Buhl, Virgil G. Kunde, and Larry W. Brown Jan. 1978 16 p refs
(NASA-TM-78067) Avail: NTIS HC A02/MF A01 CSCL 04A

A stratospheric ozone absorption line in the 10 microns band was measured and resolved completely, using an infrared heterodyne spectrometer with spectral resolution of 5 MHz (0.000167 cm to -1 power). The vertical concentration profile of stratospheric ozone was obtained through an analytical inversion of the measured spectral line profile. The absolute total column density was 0.34 cm atm with a peak mixing ratio occurring at approximately 24 km. The (7,1,6) to (7,1,7) O3 line center frequency was found to be 1043.1775 + or - 0.00033 cm to toe -1 power, or 430 + or - 10 MHz higher than the P(24) CO2 laser line frequency. Author

N78-17533*# Purdue Univ., Lafayette, Ind. Dept. of Geosciences.
UTILITY OF CORRELATION TECHNIQUES IN GRAVITY AND MAGNETIC INTERPRETATION Final Report, Nov. 1975 - Jan. 1977
V. W. Chandler, J. S. Koski, L. W. Braile, and W. J. Hinze Jan. 1977 121 p refs
(Contract NAS5-22816)
(NASA-CR-156685) Avail: NTIS HC A06/MF A01

Two methods of quantitative combined analysis, internal correspondence and clustering, are presented. Model studies are used to illustrate implementation and interpretation procedures of these methods, particularly internal correspondence. Analysis of the results of applying these methods to data from the midcontinent and a transcontinental profile show they can be useful in identifying crustal provinces, providing information on horizontal and vertical variations of physical properties over province size zones, validating long wave-length anomalies, and isolating geomagnetic field removal problems. Thus, these techniques are useful in considering regional data acquired by satellites. Author

N78-17534# Ford Motor Co., Dearborn, Mich.
THE KINETICS OF THE GAS PHASE REACTION OF O(3P) WITH N2O5 Final Report
E. W. Kaiser and S. M. Japar Sep. 1977 16 p refs
(Contract DOT-TSC-1201)
(AD-A046160; FAA-AEQ-77-11) Avail: NTIS HC A02/MF A01 CSCL 07/2

Under conditions applicable to the middle stratosphere, the kinetics of the gas phase reaction between O(3P) atoms and N2O5 have been measured in a discharge-flow mass spectrometer by observing the N2O5 fragmentation pattern at various O-atom concentrations as a function of injector distance and reactor temperature. GRA

N78-17535# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
FINITE ELEMENT MODEL OF TRANSIENT HEAT CONDUCTION WITH ISOTHERMAL PHASE CHANGE, TWO AND THREE DIMENSIONAL
G. L. Guymon and T. V. Hromadka, II Nov. 1977 168 p refs
(AD-A047369; CRREL-SR-77-38) Avail: NTIS HC A08/MF A01 CSCL 08/12

The partial differential equation for transient heat conduction is solved by a finite element analog using a quadratic weighting function for the discretized spatial domain. The transient problem is solved by the Crank-Nicolson approximation. Two-dimensional and three-dimensional models incorporated in the same computer program are presented. The finite element method is reviewed, assumptions and limitations upon which the model is based are presented, and a complete derivation of the system analog is included. Certain problems can only be modeled as a three-dimensional system, e.g. thaw degradation around roadway culverts, embankment dams on permafrost where dam length is short relative to dam width, and thaw and freezeback under buildings. In most cases, however, the more economical two-dimensional model can be used. Numerical tests of both models have been accomplished but field verification has not been attempted. A user's manual and a FORTRAN IV computer listing of the program are presented. Author (GRA)

N78-17536# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
AMPLITUDE DEPENDENT ERRORS IN THE CALCULATION OF WIENER KERNELS M.S. Thesis
Gary Robert Ellis Mar. 1977 51 p refs
(AD-A047764; AFIT-CI-78-7) Avail: NTIS HC A04/MF A01

The calculation of Wiener kernels via the cross-correlation methods of Lee and Schetzen for use in nonlinear system identification is examined. The calculated kernels are shown to depend upon the power of the input approximating a white noise probe. This dependence is due to amplitude related nonlinearities such as thresholds in the system, and is also a consequence of the finite computations used to derive the kernels. Data obtained from investigations into near field seismic energy propagation is used to calculate kernels identifying the propagation medium, and the effects of the input power level on the calculated kernels are shown. Author (GRA)

N78-17537# Photometrics, Inc., Lexington, Mass.
DATA REDUCTION AND AURORAL CHARACTERIZATIONS FOR ICECAP III Final Report, 1 Dec. 1975 - 31 Dec. 1976
I. L. Kofsky, D. P. Villanucci, and R. B. Sluder 31 Jan. 1977 207 p refs
(Contract DNA001-76-C-0161)
(AD-A047376; AD-E300009; DNA-4220F; PHM-02-77; HAES-Rept-59) Avail: NTIS HC A10/MF A01 CSCL 04/1

This report provides results of infrared radiometry of auroral particle-excited air from two ICECAP multi-instrumented rocket probes and a zenith-viewing aircraft; characterizations of the ionosphere for other simulation tests; an outline of ICECAP's 1976 program of coordinated NKC-135 aircraft and groundbased measurements; and a review of methods for assessing auroral energy inputs. Effective efficiencies for emission of what is interpreted as NO vibrational fundamental and overtone radiation are derived from several rocket probes and aircraft missions. These are consistent among themselves and within the expected precision and resolution of the measurements. The visible-fluorescent and NO-infrared radiances of relatively stable forms appear spatially and temporally correlated. Some indication of a prompt component of 4.25 + or - 0.05 micrometer auroral radiation is observed. The spectroscopic and Thomson-scatter radar methods for determining column ionization rates and altitude profiles are reviewed, with a comparison of meridian-plane data from ICECAP 75; it is found that the optical method is effective for aircraft investigations, and that scattering in the lower atmosphere strongly influences results of photometry from ground stations. GRA

N78-17538# Naval Research Lab., Washington, D. C. Plasma Dynamics Branch.
HIGH ALTITUDE ATOMIC NITROGEN DENSITIES Interim Report
E. S. Oran, D. F. Strobel, and K. Mauersberger (Minnesota Univ., Minneapolis) Sep. 1977 27 p refs
(AD-A047403; AD-E000040; NRL-MR-3597) Avail: NTIS

HC A03/MF A01 CSCL 04/1

Theoretical calculations of the seasonal and diurnal variations of atomic nitrogen are compared to measurements made by the open source neutral mass spectrometer on the AE-C satellite. Using as input the simultaneous measurements of molecular nitrogen and atomic oxygen densities, the calculations of odd nitrogen densities made with the NRL ionosphere model predict the same trends in atomic nitrogen as those observed. Estimates are given of the sensitivity of atomic nitrogen densities to variations in the photoelectron flux, the neutral temperatures, and the neutral winds. We find that within the range of uncertainties in these quantities, the magnitude of the calculated and observed atomic nitrogen densities are in good agreement. Author (GRA)

N78-17539# Utah Univ., Salt Lake City. Dept. of Meteorology.

CLOUD COMPOSITION DETERMINATION BY SATELLITE SENSING USING THE NIMBUS VI HIGH RESOLUTION INFRARED SOUNDER Interim Report

Robert G. Feddes and Kuo-Nan Liou 15 May 1977 151 p refs

(Contract F19628-75-C-0107)

(AD-A047527; AFGL-TR-77-0123; Scientific-3) Avail: NTIS MF A01 CSCL 04/1

The emphasis in this study is to detemine cloud compositions from satellites. The radiative transfer model of spectral infrared radiation in cloudy atmospheres is applied to the most complete set of radiance observations currently available from the Nimbus VI HIRS instrument. The radiative properties of clouds in the HIRS channels are investigated using the discrete-ordinate method for approximating the solution of the radiative transfer equation as it is applied to nonisothermal, inhomogeneous cloudy atmospheres. Analysis of the upwelling radiances from the model indicates that cirrus clouds decrease the upwelling radiance more than middle clouds and that multilayered middle and cirrus clouds are indistinguishable from thick cirrus clouds. Upwelling radiances in cirrus or middle cloud conditions for shortwave CO2 channels are decreased by a greater percentage from their clear column values than are the long-wave CO2 channel radiances. GRA

N78-17540# Visidyne, Inc., Burlington, Mass.

COMPARISON OF ICECAP AND EXCEDE ROCKET MEASUREMENTS WITH COMPUTER CODE PREDICTIONS Final Report, 9 Oct. 1974 - 30 Dec. 1976

A. G. Hurd, J. W. Carpenter, T. C. Degges, W. F. Grieder, W. P. Reidy, O. Shepherd, A. T. Stair, Jr., R. R. ONeil, J. C. Ulwick, D. J. Baker et al 15 Feb. 1977 256 p refs

(Contract F19628-74-C-0177)

(AD-A047526; VI-381; AFGL-TR-77-0060; DNA-HAES-61) Avail: NTIS HC A12/MF A01 CSCL 04/1

An analysis is made of rocketborne HAES experiments performed as part of the ICECAP and EXCEDE II test programs. The results are compared to atmospheric emissions from code modelling. Relationships between auroral electron spectra and visible aurora have been determined. Sources of auroral IR are explained. Author (GRA)

N78-17541# Air Force Geophysics Lab., Hanscom AFB, Mass.

SUNRISE E-REGION ENHANCEMENTS FROM AURORALLY INCREASED NO: THEORY Final Report

William Swider, Thomas J. Keneshea, and Carol I. Foley 15 Sep. 1977 23 p refs

(AD-A047923; AFGL-ERP-608) Avail: NTIS HC A02/MF A01 CSCL 04/1

E-region nitric oxide concentrations are known to be greater at high altitudes as compared to low- and midlatitudes. It is suggested that studies of electron concentration data from ionosondes and/or the Chatanika backscatter radar at night, and especially at sunrise, may be able to provide peak nitric oxide concentrations when aurora are determined to be absent. Author (GRA)

N78-17542# Naval Research Lab., Washington, D. C. Space Science Div.

REAL-TIME DISPLAY OF IONOSPHERIC ELECTRON DENSITY PROFILES FROM A ROCKET-BORNE PLASMA PROBE: THE PAYLOAD, ACQUISITION SYSTEM, AND THE REAL-TIME RESULTS Interim Report

David N. Walker, Edward P. Szuszczewicz, and Julian C. Holmes Nov. 1977 22 p refs

(RR0330242)

(AD-A047823; AD-E000064; NRL-MR-3649) Avail: NTIS HC A02/MF A01 CSCL 04/1

This is the first in a series of reports dealing with the results of a major DNA program coordinating rocket, satellite, and ground-based equatorial studies at Kwajalein Atoll in the Marshall Islands. This report concentrates on the NRL contribution to the overall program, the direct measurement of the ionospheric plasma state as determined by on-board pulsed-plasma-probe (P3) observations of electron energies, densities, and density fluctuation power spectra. In particular, we describe our newly developed data acquisition system which acquired and displayed in real-time the ionospheric electron density profile as it was being measured by the P3 technique during the rocket flight. Author (GRA)

N78-17543# Naval Research Lab., Washington, D. C. Plasma Physics Div.

THE ZONALLY AVERAGED CIRCULATION OF THE MIDDLE ATMOSPHERE Interim Report

M. Schoeberl (Sci. Appl., Inc., McLean, Va.) and D. Strobel Oct. 1977 45 p refs

(WF52551713)

(AD-A047810; AD-E000063; NRL-MR-3590) Avail: NTIS HC A03/MF A01 CSCL 04/1

The steady state, zonally averaged circulation of the middle atmosphere (15-125 km) is studied with a quasigeostrophic, numerical model that explicitly includes a self-consistent calculation of solar radiative heating due to oxygen and ozone absorption, Newtonian cooling, Rayleigh friction, tropopause boundary conditions based on climatological averages, and the effects of vertically propagating planetary waves. We find the direct, radiatively driven pole to pole circulation at solstice is sufficient to account for the cold summer mesopause and warm isothermal winter mesosphere with associated zonal jets of realistic magnitude. The climatological heat and momentum fluxes associated with planetary wave number 2 have a negligible effect on the mean circulation. With planetary wave number 1 no steady state solution could be obtained due to the formation of easterlies and hence critical layers in the winter mesosphere. We also find that the radiative heating associated with secondary peaks in the ozone density at the mesopause could render the polar mesopause region convectively unstable. GRA

N78-17544# Danish Meteorological Inst., Copenhagen.

NARSSARSSUAQ GEOPHYSICAL OBSERVATORY. MAGNETIC RESULTS 1971-1973 INSTRUMENTATION AND FORMULAS

E. Friis-Christensen, E. Ulander, and J. Wilhjelm 1976 24 p refs

(ISBN-87-7478-116-2) Avail: NTIS HC A02/MF A01

Regular recordings of magnetic declination and vertical and horizontal density values for the period 1971-73 observed at the Observatory are tabulated. ESA

N78-17545# Danish Meteorological Inst., Copenhagen.

NORD GEOPHYSICAL OBSERVATORY. MAGNETIC RESULTS 1969-72

E. Friis-Christensen and J. Wilhjelm 1976 69 p refs

(ISBN-87-7478-120-0) Avail: NTIS HC A04/MF A01

Hourly mean values of magnetic declination and horizontal and vertical intensity measured at the Observatory during August 1969 to March 1972 are presented. ESA

N78-17546# Danish Meteorological Inst., Copenhagen.

RUDE SKOV GEOPHYSICAL OBSERVATORY - MAGNETIC RESULTS 1972

Axel Hansen 1976 40 p refs

(ISBN-87-7478-127-8) Avail: NTIS HC A03/MF A01

Results of standard observations of horizontal and vertical intensity, magnetic declination, and values of magnetic elements are tabulated. ESA

N78-17547# Danish Meteorological Inst., Copenhagen.

MAGNETOMETER CHAIN IN GREENLAND

J. Wilhjelm and E. Friis-Christensen 1976 58 p refs

(DMI-Geophys-Papers-R-48; ISBN-87-7478-123-5) Avail: NTIS HC A04/MF A01

An account of the magnetometer chain in Greenland from 1972 to 73 is presented. The observatories and their instrument action are described, and the sensitivities and temperature coefficients of the magnetometers are summarized. The quiet levels of the magnetic elements at the various observatories are listed. Author (ESA)

N78-17548# Academy of Sciences (USSR), Moscow. Inst. of Space Research.

EXPERIMENTAL EVIDENCE OF OPENED AND CLOSED MAGNETOSPHERES EXISTENCE

E. M. Dubinin, I. M. Podgorny, and Y. N. Potanin 1977 21 p refs

(PR-348) Avail: NTIS HC A02/MF A01

Earlier laboratory experiments have shown the existence of plasma convection towards nightside in the region of the magnetosphere's closed field lines. Data on the convection in the polar cap are given for small Alfven's Mach numbers. The convection is mainly the result of the field lines reconnection of dipole and plasma flow. Also simultaneously observed is the convection due to viscous interaction between the plasma flow and the magnetosphere. Relative significance of each of the processes is obviously determined by Alfven's Mach number. Author (ESA)

N78-17549# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.

GENERATION MECHANISMS FOR MAGNETIC-FIELD-ALIGNED ELECTRIC FIELDS IN THE MAGNETOSPHERE

Carl-Gunne Faelthammar Sep. 1977 30 p refs Presented at the 3rd Gen. Sci. Assembly of Iaga, Seattle, 22 Aug.-3 Sep. 1977

(TRITA-EPP-77-21) Avail: NTIS HC A03/MF A01

Current driven wave instabilities can lead to either anomalous resistivity or electric double layers. Both can support potential drops of many kilovolts. Once established, such layers may exist with or without substantial wave turbulence. It has also been proposed that wave-particle interaction may establish a collisionless version of the thermoelectric effect. In the hot magnetospheric plasma potential drops can be created as a consequence of the magnetic mirror force. The mirror effect has its most dramatic impact in regions of upward Birkeland currents, where it limits the current density to moderate levels unless large voltages are applied. The distribution of this voltage depends critically on the distribution functions of the plasma particles involved, and it may well degenerate into electric double layers. Observational data now available indicate that more than one of the mechanisms mentioned are operative in the magnetosphere, but it is not yet possible to evaluate their relative importance. Author (ESA)

N78-17550# Technical Research Centre of Finland, Espoo. Reactor Lab.

INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS AS A ROUTINE METHOD FOR ROCK ANALYSIS Ph.D. Thesis - Helsinki Univ. of Technol.

Rolf J. Rosenberg 1 Jun. 1977 69 p refs Sponsored in part by Neste oy Found.

(VTT-ENT-19; ISBN-951-38-0459-3) Avail: NTIS HC A04/MF A01

Instrumental neutron activation methods for the analysis of geological samples were developed. Special emphasis was placed on the improvement of sensitivity and accuracy in order to maximize the quality of the analyses. Furthermore, the procedures were automated as far as possible in order to minimize the cost of the analysis. A short review of the basic literature is given followed by a description of the principles of the method. All aspects concerning the sensitivity are discussed thoroughly in view of the analyst's possibility of influencing them. Experimentally determined detection limits for Na, Al, K, Ca, Sc, Cr, Ti V, Mn, Fe, Ni, Co, Rb, Zr, Sb, Cs, Ba, La, Ce, Nd, Sm, Eu, Gd, Tb, Dy, Yb, Lu, Hf, Ta, Th and U are given. The errors of the method are discussed followed by actions taken to avoid them. The most significant error was caused by flux deviation, but this was avoided by building a rotating sample holder for rotating the samples during radiation. A scheme for the INAA of 32 elements is proposed. The method was automated as far as possible and an automatic spectrometer and a computer program for the automatic calculation of the results are described. Furthermore, a completely automated uranium analyzer based on delayed neutron counting is described. Some applications of the methods performed at the Reactor Laboratory are described. The methods illustrated here are discussed thoroughly in view of their applicability to rock analysis. It is stated that the sensitivity varies considerably from element to element and instrumental activation analysis is an excellent method for the analysis of some specific elements like lanthanides, thorium, and uranium but less so for many other elements. The accuracy is good varying from 2 to 10% for most elements. Instrumental activation analysis for most elements is rather an expensive method there being, however, a few exceptions. The most important of these is uranium. The analysis of uranium by delayed neutron counting is an expensive means for the analysis of large numbers of samples needed, for instance in the geochemical exploration of uranium. Author (ESA)

N78-17551# Argonne National Lab., Ill.

ADDENDUM TO USER'S GUIDE FOR CLIMATOLOGICAL DISPERSION MODEL Final Report

Kenneth L. Brubaker, Polly Brown, and R. Cirillo May 1977 140 p refs

(PB-274040/5; EPA-450/3-77-015) Avail: NTIS HC A07/MF A01 CSCL 13B

Several significant features were added to the computer program of the Climatological Dispersion Model: (1) a calibration package, (2) the capability of providing individual source contribution lists for arbitrary receptors, and (3) a Larsen averaging time transformation package. Documentation for the use of the new features is provided with descriptions of the corresponding algorithms, and guidelines for use. GRA

N78-17097*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

STRATOSPHERIC AEROSOL MEASUREMENTS: EXPERIMENT MA-007

T. J. Pepin (Wyoming Univ.), M. P. McCormick, W. P. Chu (Old Dominion Univ.), F. Simon (Wyoming Univ.), T. J. Swissler (Systems and Applied Sciences Corp.), R. R. Adams, K. H. Crumbly, and W. H. Fuller, Jr. *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 127-136 refs (For availability see N78-17088 08-12)

Avail: NTIS HC A24/MF A01 CSCL 04A

N78-17099*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

GEODYNAMICS: EXPERIMENT MA-128

F. O. Vonbun, W. D. Kahn, W. T. Wells (Washington Analytical Services Center, Inc., Riverdale, Md.), and T. D. Conrad *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 177-191 refs (For availability see N78-17088 08-12)

Avail: NTIS HC A24/MF A01 CSCL 08G

N78-17119*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

RECOVERY OF ATMOSPHERIC PARAMETERS FROM RADIO TRACKING DATA OF THE GEODYNAMICS EXPERIMENT, APPENDIX A

P. E. Schmid and S. Rangaswamy (Old Dominion Systems, Inc., Gaithersburg, Md.) *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 563-569 refs (For availability see N78-17088 08-12)

Avail: NTIS HC A24/MF A01 CSCL 08N

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N78-17552 Louisiana State Univ. and A&M Coll., Baton Rouge.

AN ANALYSIS OF THE RELATIONSHIPS BETWEEN WATER LEVEL FLUCTUATIONS AND CLIMATE, COASTAL LOUISIANA Ph.D. Thesis

Charles Larry Wax 1977 114 p
Avail: Univ. Microfilms Order No. 77-25406

Mean regional water level response was established for eight synoptic weather types in coastal Louisiana. The weather types were coupled with numerically filtered water level data representing meteorologically driven water level changes. The forcing function of climatic components on complex process-response interactions were evaluated through the use of this coupling. Passages of cold and warm fronts, and the veering of winds from northerly to coastal region were found to cause the strongest, most clearly defined relationships. Dissert. Abstr.

N78-17553 Colorado State Univ., Fort Collins.
A TIME-DEPENDENT MODEL OF THE TRADE-WIND BOUNDARY LAYER Ph.D. Thesis
Bruce Allen Albrecht 1977 186 p
Avail: Univ. Microfilms Order No. 77-28291

A numerical model which predicts the time variation of the convective boundary layer is described. The time dependent capability of the model is demonstrated by simulating the reformation of the trade-wind boundary layer in the wake of disturbed conditions. The growth rate of the depth of the boundary layer is shown to be most sensitive to parameters which directly influence the surface fluxes of heat and moisture. The model used to study the effect of a diurnally varying radiative heating and large-scale divergence on the height of the inversion, and to simulate the thermodynamic structure when the cloud layer becomes saturated (assuming no precipitation). Dissert. Abstr.

N78-17554 Miami Univ., Coral Gables, Fla.
THE DYNAMICS OF INERTIA-BUOYANCY WAVES IN HURRICANES Ph.D. Thesis
Hugh Edward Willoughby 1977 156 p
Avail: Univ. Microfilms Order No. 77-28943

A model of hurricane rainbands as linear waves on an axisymmetric vortex in gradient balance was developed. The model is presented in two forms. One has a barotropic mean flow, and the waves are confined in the vertical between reflecting boundaries at the surface and the tropopause. In the other, the mean flow is baroclinic, and the waves are allowed to propagate vertically through the upper boundary. All growing waves sustain a horizontal flux of angular momentum out of the vortex and obtain their energy at the expense of the mean kinetic energy. In the baroclinic model the waves also extract energy from the mean available potential energy, but the horizontal barotropic process still predominates. Dissert. Abstr.

N78-17555 Georgia Inst. of Tech., Atlanta.
A MODEL FOR TURBULENT DIFFUSION IN THE ATMOSPHERE Ph.D. Thesis
Kothappallyl Kurian Mani 1977 126 p
Avail: Univ. Microfilms Order No. 77-29214

An approach was taken which can be used in atmospheric diffusion studies without being concerned about the limitations of K-theory or similarity approaches. Starting with the equations of motion a set of equations were derived for the variances of the cloud coordinates which are functions of time. This set of equations can be used for different atmospheric stabilities and also in the presence of wind shear and gives values for the cross correlations between the cloud coordinates. Dissert. Abstr.

N78-17556 Georgia Inst. of Tech., Atlanta.
ATMOSPHERIC BOUNDARY LAYER SIMILARITY THEORY FOR APPLICATIONS IN WIND ENERGY FIELDS Ph.D. Thesis
Amir Samaan Mikhail 1977 139 p
Avail: Univ. Microfilms Order No. 77-28577

Two sets of tower data were used to investigate the possibility of establishing a theoretical model for projection of wind speed with height within and the atmospheric boundary layer using wind speed at a prefixed level and net radiation for boundary conditions. The required value of net radiation can either be measured directly or estimated. The results obtained indicate the soundness of the methodology for levels of practical importance to wind energy applications. Dissert. Abstr.

N78-17557*# Michigan Univ., Ann Arbor. Dept. of Atmospheric and Oceanic Science.
RAIN SCAVENGING OF SOLID ROCKET EXHAUST CLOUDS Annual Report, Oct. 1975 - Dec. 1976
A. Nelson Dingle Washington NASA Jan. 1978 64 p refs (Grant NsG-1243)
(NASA-CR-2928; Rept-014311-2-P) Avail: NTIS HC A04/MF A01 CSCL 04B

An explicit model for cloud microphysics was developed for application to the problem of co-condensation/vaporization of HCl and H2O in the presence of Al2O3 particulate nuclei. Validity of the explicit model relative to the implicit model, which has been customarily applied to atmospheric cloud studies, was demonstrated by parallel computations of H2O condensation upon (NH4)2 SO4 nuclei. A mesoscale predictive model designed to account for the impact of wet processes on atmospheric dynamics is also under development. Input data specifying the equilibrium state of HCl and H2O vapors in contact with aqueous HCl solutions were found to be limited, particularly in respect to temperature range. Author

N78-17558*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AUTOMATED METEOROLOGICAL DATA FROM COMMERCIAL AIRCRAFT VIA SATELLITE: PRESENT EXPERIENCE AND FUTURE IMPLICATIONS
Robert Steinberg 1978 7 p refs Presented at Intern. Conf. on Maritime and Aeron. Satellite Commun. and Navigation, London, 7-10 Mar. 1978; sponsored by Institution of Elec. Eng.
(NASA-TM-73750; E-9323) Avail: NTIS HC A02/MF A01 CSCL 04B

A low-cost communications system to provide meteorological data from commercial aircraft, in neat real-time, on a fully automated basis has been developed. The complete system including the low profile antenna and all installation hardware weighs 34 kg. The prototype system was installed on a B-747 aircraft and provided meteorological data (wind angle and velocity, temperature, altitude and position as a function of time) on a fully automated basis. The results were exceptional. This concept is expected to have important implications for operational meteorology and airline route forecasting. Author

N78-17559# World Meteorological Organization, Geneva (Switzerland).
LECTURES ON FORECASTING OF TROPICAL WEATHER, INCLUDING TROPICAL CYCLONES, WITH PARTICULAR RELEVANCE TO AFRICA
1977 351 p refs Proc. of WMO Seminar, Dakar, Senegal, 15-26 Nov. 1976
(WMO-492; ISBN-92-63-10492-1) Avail: NTIS HC A16/MF A01; WMO, Geneva

The report is in six parts: part 1 is devoted to analytical techniques with special emphasis on interpretation of satellite images and data; part 2 is devoted to descriptions of weather systems affecting Africa with mention of tropical cyclones; part 3 contains contributions on forecasting techniques; part 4 covers the meteorological needs of hydrology and agriculture; while part 5 summarizes the state of planning of WAMEY; and part 6 contains a number of specialist contributions on numerical studies and satellite techniques. For individual titles, see N78-17560 through N78-17579.

N78-17560# World Meteorological Organization, Geneva (Switzerland).
STREAMLINE AND ISOTACH ANALYSIS
G. Dugdale *In its* Lectures on Forecasting of Trop. Weather, Including Trop. Cyclones, with Particular Relevance to Africa 1977 p 3-6 (For availability see N78-17559 08-47)
Avail: NTIS HC A16/MF A01; WMO Geneva

The objectives and methods of streamline and isotach analysis for tropical weather forecasting are outlined, and definitions and illustrations used in streamline analysis techniques are given. ESA

N78-17561# World Meteorological Organization, Geneva (Switzerland).
VORTICITY, DIVERGENCE AND VERTICAL MOTION FIELDS
R. P. Pearce *In its* Lectures on Forecasting of Trop. Weather, Including Trop. Cyclones, with Particular Relevance to Africa 1977

p 7-21 (For availability see N78-17559 08-47)
Avail: NTIS HC A16/MF A01; WMO, Geneva

Two techniques are described for the determination of vorticity, divergence, and vertical motion fields starting from a standard streamline (or isogon) and isotach analysis. The first of these makes use of a graduated scale and is subjective; the second is semi-objective in the sense that numerical values of wind speed and direction are read off subjectively analyzed charts and the calculation then carried out exactly. ESA

N78-17562# World Meteorological Organization, Geneva (Switzerland).
PRACTICAL EXAMPLES, INCLUDING INTERPRETATION OF SATELLITE DATA
G. Dugdale and R. P. Pearce *In its* Lectures on Forecasting of Trop. Weather, Including Trop. Cyclones, with Particular Relevance to Africa 1977 p 22-38 (For availability see N78-17559 08-47)
Avail: NTIS HC A16/MF A01; WMO, Geneva

The weather of West Africa from Sep. 9 to 11, 1974, is first described, together with the satellite data used in practical analysis sessions. How the data is then analyzed to identify the major synoptic and sub-synoptic features and the associated kinematics of the air flow are then discussed. ESA

N78-17563# World Meteorological Organization, Geneva (Switzerland).
THE INFLUENCE OF EASTERLY WAVES ON THE PATTERNS OF PRECIPITATION IN TROPICAL NORTHERN AFRICA
Robert W. Burpee *In its* Lectures on Forecasting of Trop. Weather, Including Trop. Cyclones, with Particular Relevance to Africa 1977 p 41-71 (For availability see N78-17559 08-47)
Avail: NTIS HC A16/MF A01; WMO, Geneva

Current knowledge of the origin, structure, and energetics of synoptic-scale waves is reviewed and the waves are related to other weather features of tropical north Africa. The summer climate and seasonal and regional characteristics are discussed and seasonal correlations made between the mean flow patterns and the surface weather. ESA

N78-17564# World Meteorological Organization, Geneva (Switzerland).
STRUCTURE OF TROPICAL CYCLONES
G. O. P. Obasi *In its* Lectures on Forecasting of Trop. Weather, Including Trop. Cyclones, with Particular Relevance to Africa 1977 p 72-101 (For availability see N78-17559 08-47)
Avail: NTIS HC A16/MF A01; WMO, Geneva

Following a differentiation between tropical cyclones and tropical vortices, areas of cyclone formation and their origin statistics are given. The primary genesis parameters are listed and the evolution of the average tropical cyclone from birth to death is traced. The incipient-immature stage structure of a tropical cyclone and the mature stage structure are described in detail. ESA

N78-17565# World Meteorological Organization, Geneva (Switzerland).
FORECASTING TECHNIQUES FOR WEST AFRICA
E. V. Chelam *In its* Lectures on Forecasting of Trop. Weather, Including Trop. Cyclones, with Particular Relevance to Africa 1977 p 105-125 (For availability see N78-17559 08-47)
Avail: NTIS HC A16/MF A01; WMO, Geneva

Qualitative weather forecasting techniques, including kinematic, persistence and extrapolation methods, and techniques based on numerical and synoptic methods are reviewed with specific reference to the tropics and West Africa. ESA

N78-17566# World Meteorological Organization, Geneva (Switzerland).
FORECASTING TECHNIQUES IN EAST AFRICA
G. O. P. Obasi *In its* Lectures on Forecasting of Trop. Weather, Including Trop. Cyclones, with Particular Relevance to Africa 1977 p 126-150 (For availability see N78-17559 08-47)
Avail: NTIS HC A16/MF A01; WMO, Geneva

The objectives of meteorological analysis and existing analysis techniques are reviewed. The modeling of contour configurations in low altitudes having preferred flow characteristics is discussed and analytic expressions are derived for primary models. Low altitude contour analysis as practiced in East Africa is discussed and other routinely analyzed fields are listed. ESA

N78-17567# World Meteorological Organization, Geneva (Switzerland).
THE PREDICTION OF TROPICAL CYCLONES
G. O. P. Obasi *In its* Lectures on Forecasting of Trop. Weather, Including Trop. Cyclones, with Particular Relevance to Africa 1977 p 151-165 (For availability see N78-17559 08-47)
Avail: NTIS HC A16/MF A01; WMO, Geneva

Three points concerning the prediction of tropical cyclones are discussed. These are: whether or not an incipient tropical vortex will intensify into a mature tropical cyclone; whether or not after development the storm will recurve; and the prediction of its track. ESA

N78-17568# World Meteorological Organization, Geneva (Switzerland).
THE FUNDAMENTALS OF NUMERICAL WEATHER PREDICTION AND THE FILTERED BAROTROPIC MODEL
T. N. Krishnamurti and R. P. Pearce *In its* Lectures on Forecasting of Trop. Weather, Including Trop. Cyclones, with Particular Relevance to Africa 1977 p 166-192 (For availability see N78-17559 08-47)
Avail: NTIS HC A16/MF A01; WMO, Geneva

The concepts of vorticity and vorticity advection are described and related to the basic dynamics of barotropic models. Parcel and domain invariants of barotropic flows are reviewed together with numerical prediction techniques. An example of numerical prediction using the FSU filtered barotropic model is described. ESA

N78-17569# World Meteorological Organization, Geneva (Switzerland).
PRIMITIVE EQUATION MODELS AND THEIR APPLICATION TO THE TROPICS
T. N. Krishnamurti *In its* Lectures on Forecasting of Trop. Weather, Including Trop. Cyclones, with Particular Relevance to Africa 1977 p 193-214 (For availability see N78-17559 08-47)
Avail: NTIS HC A16/MF A01; WMO, Geneva

Following a description of the one-level primitive equation, model numerical prediction techniques are discussed with reference to the semi-Lagrangian advective scheme used in Florida State University's primitive equation model. Physical processes, in particular, radiation, relevant to the African land mass are considered and prediction with a multilevel prediction model is described. ESA

N78-17570# World Meteorological Organization, Geneva (Switzerland).
USE OF CLIMATOLOGY AS A FORECASTING AID, PART 1
R. S. Vasic *In its* Lectures on Forecasting of Trop. Weather, Including Trop. Cyclones, with Particular Relevance to Africa 1977 p 215-219 (For availability see N78-17559 08-47)
Avail: NTIS HC A16/MF A01; WMO, Geneva

The background and present situation of the climatology of inter-tropical Africa is reviewed and climatology as a forecasting aid is summarized. ESA

N78-17571# World Meteorological Organization, Geneva (Switzerland).
USE OF CLIMATOLOGY AS A FORECASTING AID, PART 2
M. Giraud *In its* Lectures on Forecasting of Trop. Weather, Including Trop. Cyclones, with Particular Relevance to Africa 1977 p 220-223 (For availability see N78-17559 08-47)
Avail: NTIS HC A16/MF A01; WMO, Geneva

The checking and storage of surface data in Asecna is described, and an example of the use of climatology in medium range forecasting is given. ESA

N78-17572# World Meteorological Organization, Geneva (Switzerland).
METEOROLOGICAL FORECASTING FOR AGRICULTURE
D. Rijks *In its* Lectures on Forecasting of Trop. Weather, Including Trop. Cyclones, with Particular Relevance to Africa 1977 p 227-232 (For availability see N78-17559 08-47)

Avail: NTIS HC A16/MF A01; WMO, Geneva

The weather forecast requirements of agricultural users are reviewed. These are: forecasts dealing with expected conditions and the range of their bear to gear variability obtained from statistical analysis of long series of data; and forecasts dealing with the timing and sequence of day-to-day agricultural activities. Fields of application of meteorological forecasts in agriculture including soil water balance, rainfall, evaporation, temperature, humidity, and wind are discussed. ESA

N78-17573# World Meteorological Organization, Geneva (Switzerland).

METEOROLOGICAL FORECASTING FOR HYDROLOGISTS

W. G. Owen *In its* Lectures on Forecasting of Trop. Weather, Including Trop. Cyclones, with Particular Relevance to Africa 1977 p 233-240 (For availability see N78-17559 08-47)

Avail: NTIS HC A16/MF A01; WMO, Geneva

The occurrence and movement of water in the hydrological cycle is described and the main concerns and forecasting requirements of hydrologists are reviewed. The main characteristics according to which hydrological forecasts may be classified are noted and the data requirements of hydrological forecasting are summarized. ESA

N78-17574# World Meteorological Organization, Geneva (Switzerland).

THE WEST AFRICAN MONSOON EXPERIMENT (WAMEX)

G. Dhonneur, D. Mandengue, and S. Mbele-Mbong *In its* Lectures on Forecasting of Trop. Weather, Including Trop. Cyclones, with Particular Relevance to Africa 1977 p 243-251 (For availability see N78-17559 08-47)

Avail: NTIS HC A16/MF A01; WMO, Geneva

The scientific objectives of the West African monsoon study (WAMEX) are reviewed and the three main scales - planetary, synoptic, and sub-synoptic - necessary to define the monsoon phenomenon are discussed. The main components of WAMEX, notably summer monsoon, winter problems, and orographic effects, are listed and the winter problems considered in detail. ESA

N78-17575# World Meteorological Organization, Geneva (Switzerland).

A STUDY OF 'SYNOPTIC TYPES' OF THE AFRICAN EASTERLY PERTURBATION

D. O. Adefolalu *In its* Lectures on Forecasting of Trop. Weather, Including Trop. Cyclones, with Particular Relevance to Africa 1977 p 255-271 (For availability see N78-17559 08-47)

Avail: NTIS HC A16/MF A01; WMO, Geneva

The characteristics of monsoon troughs are summarized and the evolution of synoptic types of the easterly perturbation is described. These synoptic types are classified into A and B perturbations and the characteristic features of each are given. The distribution of significant weather associated with synoptic types is also described. ESA

N78-17576# World Meteorological Organization, Geneva (Switzerland).

NUMERICAL STUDY OF CONVECTIVE CUMULUS IN THE WET TROPICAL ENVIRONMENT

A. S. Achy, V. Bagui, and J. Baudet *In its* Lectures on Forecasting of Trop. Weather, Including Trop. Cyclones, with Particular Relevance to Africa 1977 p 272-286 (For availability see N78-17559 08-47)

Avail: NTIS HC A16/MF A01; WMO, Geneva

Following assumptions made on cloud models, the mathematical equations are given and results from radiosoundings are computed. A comparison of model results with observation is made. ESA

N78-17577# World Meteorological Organization, Geneva (Switzerland).

NUMERICAL PREDICTION MODELS UNDER DEVELOPMENT AT THE REGIONAL METEOROLOGICAL CENTRE, ORAN

A. Benlahrech *In its* Lectures on Forecasting of Trop. Weather, Including Trop. Cyclones, with Particular Relevance to Africa 1977 p 287-293 (For availability see N78-17559 08-47)

Avail: NTIS HC A16/MF A01; WMO, Geneva

Two numerical weather prediction models - the barotropic and the baroclinic - using filtered equations are described. The equations used in each are given together with the method of calculation. Numerical results are briefly summarized. ESA

N78-17578# World Meteorological Organization, Geneva (Switzerland).

METEOROLOGICAL DATA FROM SATELLITES

P. DeFelice *In its* Lectures on Forecasting of Trop. Weather, Including Trop. Cyclones, with Particular Relevance to Africa 1977 p 294-302 (For availability see N78-17559 08-47)

Avail: NTIS HC A16/MF A01; WMO, Geneva

Measurements obtained from meteorological satellites are described and compared with those obtained by mere traditional methods. The measurements relate to long wave radiation, surface temperature, vertical distribution of atmospheric temperature, atmospheric humidity distribution, and wind vectors. ESA

N78-17579# World Meteorological Organization, Geneva (Switzerland).

THEORY OF SATELLITE ORBITS

Z. Agbagla *In its* Lectures on Forecasting of Trop. Weather, Including Trop. Cyclones, with Particular Relevance to Africa 1977 p 303-310 (For availability see N78-17559 08-47)

Avail: NTIS HC A16/MF A01; WMO, Geneva

Factors in orbit calculation such as height and period are discussed and followed by a description of heliosynchronous orbits. Definitions of a number of terms used in orbital mechanics are given. Geographical gridding of satellite pictures is described. ESA

N78-17580# World Meteorological Organization, Geneva (Switzerland).

INSTRUMENTS AND METHODS OF OBSERVATION

1977 270 p refs Partly in ENGLISH and partly in FRENCH Proc. of WMO Tech. Conf., Hamburg, 27-30 Jul. 1977 (WMO-480; ISBN-92-63-10480-8) Avail: NTIS HC A12/MF A01

A wide range of recent developments in meteorological instruments, new measurement techniques, and methods of observation are covered. For individual titles, see N78-17581 through N78-17630.

N78-17581# World Meteorological Organization, Geneva (Switzerland).

EQUIPMENT FOR RAIN STRUCTURE MEASUREMENTS ON A FIVE SECOND TIME BASE

Lothar J. Breuer *In its* Instr. and Methods of Observation 1977 p 1-6 refs (For availability see N78-17580 08-47)

Avail: NTIS HC A12/MF A01

In order to obtain rain intensity distributions on a five second time base, four transducer leads were installed at the corners of a 2 m square, giving a total receiving area of 200 sq cm. It was found that much fewer rain structures could be obtained than with equipment based on a one minute time base. Some rainfall events are summarized. ESA

N78-17582# World Meteorological Organization, Geneva (Switzerland).

METEOROLOGICAL MEASUREMENTS UNDER CONDITIONS OF ICING: SOME NEW ATTEMPTS TO SOLVE THE PROBLEM

I. C. Strangeways and J. C. Curran *In its* Instr. and Methods of Observation 1977 p 7-12 refs (For availability see N78-17580 08-47)

Avail: NTIS HC A12/MF A01

A description is given of two automatic weather stations situated on the summit of Cairngorm (1245 m Scotland), and the techniques employed to prevent icing. These include thermal protection, black surfaces to absorb solar energy and so speed melting, and preventing ice adhesion by providing flexible and slippery surfaces. ESA

N78-17583# World Meteorological Organization, Geneva (Switzerland).

A MICROPROCESSOR-BASED AUTOMATIC WEATHER STATION

T. W. Harrold, E. P. Ward, P. C. Dibben, and R. Webb *In its* Instr. and Methods of Observation 1977 p 13-18 refs (For

availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

The potential advantages of using a microprocessor in an automatic weather station are outlined. The UK Meteorological Office's requirements for an efficient system are reviewed and the development of a microprocessor based data acquisition and processing system is described. ESA

N78-17584# World Meteorological Organization, Geneva (Switzerland).
A NEW, FULLY AUTOMATIC RADIOSONDE GROUNDSTATION FOR USE WITH THE UNITED KINGDOM Mk 3 RADIOSONDE
R. E. W. Pettifer and D. N. Axford *In its* Instr. and Methods of Observation 1977 p 19-23 refs (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

A brief description of the UK Mk3 radiosonde is given to facilitate comprehension of the functions of the ground station and calibration equipment which are described. The radiosonde, computer controlled central calibration facility and the computer controlled ground station form an interdependent net, no member of which is able to function fully without the other. The meteorological sensors, flight computation and output from the Mk3 system are also discussed. ESA

N78-17585# World Meteorological Organization, Geneva (Switzerland).
THE ACCURACIES AND RELATIVE COSTS OF UPPER WIND DATA OBTAINED USING RADIOTHEODOLITES, PRIMARY RADARS AND NAVAID RETRANSMISSION SYSTEMS
P. J. Bacon *In its* Instr. and Methods of Observation 1977 p 25-28 refs (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

Following a brief description of three techniques - radiotheodolites, radar tracking, and navaid retransmission - for measurement of upper winds the accuracies of each system are discussed and typical total costs of ownership are determined. ESA

N78-17586# World Meteorological Organization, Geneva (Switzerland).
COMPATIBILITY OF STRATOSPHERIC DATA
F. G. Finger and R. M. McInturff *In its* Instr. and Methods of Observation 1977 p 29-34 refs (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

The problems for the stratospheric meteorologist caused by a multitude of different types of observing system each with its own peculiarities and characteristic errors are considered. The compatibility between stratospheric in situ observations are discussed and comparisons between rawinsonde/rocketsonde-satellites are drawn. ESA

N78-17587# World Meteorological Organization, Geneva (Switzerland).
THE BOULDER ATMOSPHERIC OBSERVATORY - A FACILITY FOR ATMOSPHERIC RESEARCH AND INSTRUMENT COMPARISON
J. C. Kaimal *In its* Instr. and Methods of Observation 1977 p 35-38 (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

A new facility consisting of an instrumental 500 m tower, remote sensors of various types measuring atmospheric parameters, and a highly interactive system controlling the processing and display of the acquired data, and designed to serve as a national resource for atmospheric research and instrument testing is under construction near Boulder, Colorado. The tower, the instrumentation on it, and its potential for atmospheric studies and for testing and calibrating meteorological sensors are described. ESA

N78-17588# World Meteorological Organization, Geneva (Switzerland).
WIND REPRESENTATIVITY INCREASE DUE TO AN EXPOSURE CORRECTION OBTAINABLE FROM PAST ANALOG STATION WIND RECORDS
J. Wieringa *In its* Instr. and Methods of Observation 1977 p 39-44 refs (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

It is shown that gust-derived exposure corrections can aid operationally in the objective reduction of wind measurements from sheltered stations as well as the estimation of wind over arbitrary terrain close to a wind station, and the homogenization of station wind time series. Necessary and sufficient information for such an analysis is a set of gust data for strong winds, classified according to azimuth, for an instrument configuration of known response characteristics. ESA

N78-17589# World Meteorological Organization, Geneva (Switzerland).
PASSIVE REMOTE CROSSWIND SYSTEM
Thomas H. Pries, Ruben Rodriguez, Donald L. Walters, Gerard R. Ochs, and Robert S. Lawrence *In its* Instr. and Methods of Observation 1977 p 45-49 refs (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

The use of atmospheric scintillation of light beams to measure the average wind blowing across the beam is discussed. An improvement to existing equipment in which the artificial light source is replaced by ambient light from a natural source is described. The capabilities and possible applications of the new system are discussed. ESA

N78-17590# World Meteorological Organization, Geneva (Switzerland).
INFLUENCE OF DEFINITION ON RAINFALL EVENTS, LENGTH, FREQUENCY AND OTHER PRECIPITATION STATISTICS
R. K. Kreuels and L. J. Breuer *In its* Instr. and Methods of Observation 1977 p 50-54 refs (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

A general discourse is made on the necessity for having some obligatory definition of rain in view of the sophistication of present rain measuring devices. The definition needs to take into account the minimum duration of the rain, the minimum intensity, and drop size in order to identify onset and cessation of the rain event. ESA

N78-17591# World Meteorological Organization, Geneva (Switzerland).
TRANSMISSION AND PROCESSING OF RADAR IMAGES [TRANSMISSION ET PRESENTATION DES IMAGES RADAR]
H. P. Treussart *In its* Instr. and Methods of Observation 1977 p 55-60 refs In FRENCH (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

A new digital system for the processing and visualization of radar video signals is presented. An experiment carried out in 1976 at Trappes, Charles de Gaulle airport has allowed the evaluation of this equipment performances. It is concluded that the adaptation of digital techniques to meteorological radar has allowed the application of this equipment to multiple access in meteorology such as synoptic meteorology, hydrology, as well as aeronautics. ESA

N78-17592# World Meteorological Organization, Geneva (Switzerland).
FGGE NAVAID SOUNDING SYSTEM
Erkki Jatila *In its* Instr. and Methods of Observation 1977 p 61-64 (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

A description is given of the basic and complete versions of an FGGE navaid sounding system designed to determine the vertical wind structure in the tropics. The basic system receives data transmitted by the radiosonde and record data on magnetic tape. In addition to this the complete system processes the data into TEMP messages by utilizing a minicomputer. ESA

N78-17593# World Meteorological Organization, Geneva (Switzerland).
AUTOMATIC HELIOGRAPH AND INSULATION DURATION [HELIOGRAPHE AUTOMATIQUE ET DUREE D'INSOLATION]

J.-L. Plazy *In its* Instr. and Methods of Observation 1977 p 65-69 In FRENCH (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

An automatic heliograph developed to measure with high precision the insolation duration is described. Its performance is assessed by comparing the experimental results to those obtained when using a Campbell HaB heliograph during an 18-month period. ESA

N78-17594# World Meteorological Organization, Geneva (Switzerland).
SYSTEM ETADAM: AN AUTOMATIC SYSTEM FOR THE PROCESSING OF HIGH ALTITUDE METEOROLOGICAL DATA [ENSEMBLE DE TRAITEMENT AUTOMATIQUE DES DONNEES EN ALTITUDE METEOROLOGIQUES. SYSTEME ETADAM]
C. Fichaux *In its* Instr. and Methods of Observation 1977 p 70-73 In FRENCH (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

An automatic system developed for the acquisition, recording, and processing of altitude meteorological data is described. It includes a 403 MHz radiosonde equipped with a thermistor, a wind radar, a minicomputer, and peripheral units. The installation specifications are presented and its performance assessed. ESA

N78-17595*# World Meteorological Organization, Geneva (Switzerland).
STRAIN GAGE BAROMETRIC TRANSMITTER [TRANSMITTEUR BAROMETRIQUE A GAUGES DE CONTRAINTE]
P. Viton *In its* Instr. and Methods of Observation 1977 p 74-77 In FRENCH (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

A strain gage barometric transmitter for measuring the atmospheric pressure in severe environmental conditions is described. This equipment specifications are presented and its performance assessed. It is shown that this barometric sensor can measure the atmospheric pressure with a precision of 0.5 mb during a 6 month period. ESA

N78-17596# World Meteorological Organization, Geneva (Switzerland).
AUTOMATIC EQUIPMENT FOR SURFACE OBSERVATIONS IN FRANCE [EQUIPEMENT AUTOMATIQUE POUR L'OBSERVATION DE SURFACE EN FRANCE]
A. Bettan and P. Viton *In its* Instr. and Methods of Observation 1977 p 78-84 In FRENCH (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

The automatic weather stations Simoun for synoptic meteorological data acquisitions and processing, the weather station Delta for difficult access site meteorological observations are described, their equipment specifications inserted, and operating performances assessed. In addition another automatic weather station for acquisition and processing of precipitation as well as the air temperature data is described, and its principal characteristics presented. ESA

N78-17597# World Meteorological Organization, Geneva (Switzerland).
AN ELECTRONIC LOW CONSUMPTION INTEGRATOR [UN INTEGRATEUR ELECTRONIQUE A FAIBLE CONSOMMATION]
J. Olivieri *In its* Instr. and Methods of Observation 1977 p 85-90 In FRENCH (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

A low consumption electronic integrator to be used as automatic actinometer functioning in a temperature range from -30 C to + 60 C is described. The integrator performance achieved is presented. ESA

N78-17598# World Meteorological Organization, Geneva (Switzerland).
A DIGITAL CONTINUOUSLY UPDATED TWO MINUTE MEAN WINDSPEED INDICATOR FOR USE AT AIRPORTS
G. Venugopal and G. P. Srivastava *In its* Inst. and Methods of Observation 1977 p 91-96 refs (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

A digital average windspeed measuring equipment for use at airports, based on the measurement of the total wind run for 2 minute periods continuously updated every 10 seconds is described. The quipment consists of a photoelectric cup anemometer for sensing the wind, a computer for computing the mean windspeed, a programmer to control the computer operations and a seven segment numeric indicator to display the information. ESA

N78-17599# World Meteorological Organization, Geneva (Switzerland).
A MODIFIED TECHNIQUE FOR THE MEASUREMENT OF CLOUD HEIGHT
C. R. Sreedharan *In its* Instr. and Methods of Observation 1977 p 97-99 ref (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

The equipment consists of a fixed pulse projector and a detector array with a spherical lens and a multiple recording head. The system is advantageous in that it can detect virtually every cloud passing over the projector and does not use any moving parts hence it should prove easy to operate and maintain. ESA

N78-17600# World Meteorological Organization, Geneva (Switzerland).
A CURRENT WEATHER INFORMATION DISPLAY SYSTEM FOR USE AT AIRPORTS
G. Venugopal and G. P. Srivastava *In its* Instr. and Methods of Observation 1977 p 100-104 (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

A description is given of the current weather display system in use at Indian airports. The system consists of conventional sensors for wind direction, wind speed, dew point, and air temperature. The system electronics comprise an analog multiplexer, and A/D converter, a storage and serializer unit as well as the display and power supply. ESA

N78-17601# World Meteorological Organization, Geneva (Switzerland).
AN AUTOMATIC WEATHER STATION SYSTEM: OPERATING EXPERIENCE
R. J. Munster *In its* Instr. and Methods of Observation 1977 p 105-110 (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

The New Zealand network of synoptic automatic weather reporting stations used to provide acceptable geographical coverage and continuity of time is discussed. The equipment requirements for the automatic weather station are listed and the function of each element is described. The meteorological sensors and the data interfaces are reviewed and operational experince with the stations, which are linked together by 50 band switched telex circuits, is reviewed. ESA

N78-17602# World Meteorological Organization, Geneva (Switzerland).
LIGHTNING WARNING SET
Pio J. Petrocchi and Edwin B. Dickson *In its* Instr. and Methods of Observation 1977 p 111-113 (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

An instrument providing advanced warning of potentially hazardous electrical activity which could interfere with airfield operations is described. The device - lightning warning setmakes and displays two types of measurements of the earth's electric field. It measures the slowly changing electric field, which serves as an indication of hazardous electrical activity developing overhead, and it measures the abrupt changes in the electric field caused by lightning discharges within a radius of 75 km. Field tests using the set are described and its application discussed. ESA

N78-17603# World Meteorological Organization, Geneva (Switzerland).
THE CANADIAN MINISONDE SYSTEM
M. E. Still and G. L. Klein *In its* Instr. and Methods of Observation 1977 p 114-118 (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

To gather frequent vertical profiles of temperature and wind in the lower atmosphere a small light-weight balloon-borne expendable sonde was developed. The major components of the sonde system - flight package, ground receiving station, and dual optical tracking system - are described and test results given. ESA

N78-17604# World Meteorological Organization, Geneva (Switzerland).
AN OPERATIONAL DOPPLER-ACOUSTIC REMOTE WIND SENSOR
Martin Balser *In its* Instr. and Methods of Observation 1977 p 119-123 refs (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

The principles by which a Doppler-acoustic remote wind sensor operates are described. Basically there are the use of acoustic waves as a probe to interact with the air from a distance and the measurement of Doppler shifts in the incident frequency which depend on the velocity of the acoustic scatter. The remaining components of the sensor system are briefly mentioned and results of a test program are reviewed. ESA

N78-17605# World Meteorological Organization, Geneva (Switzerland).
MEASUREMENT OF SNOW WATER EQUIVALENT BY COSMIC RAY NEUTRON TECHNIQUE
M. Kodama, S. Kawasaki, K. Nakai, and M. Wada *In its* Instr. and Methods of Observation 1977 p 124-128 refs (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

The defects of present techniques for measuring the water equivalent depth of snowpack are reviewed and the advantages of using atmospheric slow neutrons produced by cosmic rays are noted. The attenuation of cosmic ray neutrons in water is discussed and observation results of the neutron technique under snowpack are presented. ESA

N78-17606# World Meteorological Organization, Geneva (Switzerland).
MEASUREMENT OF SPECTRAL RADIATIVE FLUX ON A HORIZONTAL PLANE [MESURE DU FLUX RADIATIF SPECTRAL SUR UN PLAN HORIZONTAL]
D. Crommelynck *In its* Instr. and Methods of Observation 1977 p 129-131 In FRENCH (For availability see N78-17580 08-47)
Copyright. Avail: NTIS HC A12/MF A01

In order to determine the budget of natural radiative sources and to develop the future solar sensors vs the spectral sensitivity an equipment was developed for the observation of the spectral radiative flux at eight wavelengths (315, 400, 451, 490, 651, 730, 828, and 930 nm). It includes a diffuser, interferential filters, and a photodiode supplying the power to a preamplifier. The electronic circuit includes a second photodiode. ESA

N78-17607# World Meteorological Organization, Geneva (Switzerland).
MAPS - READAC: A CONCEPT IN METEOROLOGICAL DATA ACQUISITION
R. VanCauwenberghe *In its* Instr. and Methods of Observation 1977 p 132-137 ref (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

The development and design of a modular meteorological data acquisition system is described. Comprising two elements MAPS (Modular Acquisition and Programming System) and READAC (Remote Environmental Automatic Data Acquisition Concept), the system will enable the user to choose, from available spheres, the sensors he wants to use and the type of communication he needs. ESA

N78-17608# World Meteorological Organization, Geneva (Switzerland).
DIRECT MEASUREMENT OF THE DIVERGENCE OF RADIATIVE FLUX IN THE ATMOSPHERE [MESURE DIRECTE DE LA DIVERGENCE DU FLUX RADIATIF DANS L'ATMOSPHERE]
D. Crommelynck *In its* Instr. and Methods of Observation 1977 p 138-143 In FRENCH (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

An instrument was developed for the measurement of the divergence of radiative flux in the atmosphere. Its operational principles are presented. Measurements were carried out using meteorological balloons. The measurements of the divergence of radiative flux were analyzed by comparing the values deduced from the energy budget equation. In addition measurements at 2 m height were qualitatively analyzed. ESA

N78-17609# World Meteorological Organization, Geneva (Switzerland).
OPTICAL FLASH DETECTOR [DETECTEUR OPTIQUE D'ECLAIRS]
J. Olivieri *In its* Instr. and Methods of Observation 1977 p 144-146 In FRENCH (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

An optical instrument to acquire and measure lightning data is described. Its performances are presented and experimental results during short light discharge simulation are discussed. ESA

N78-17610# World Meteorological Organization, Geneva (Switzerland).
UTILIZATION OF NEW ZEALAND ASTRONOMICAL OBSERVATORIES FOR MONITORING ATMOSPHERIC TURBIDITY
P. J. Edwards *In its* Instr. and Methods of Observation 1977 p 147-152 refs (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

The methods used in the data collection and analysis of a turbidity monitoring network using photoelectric stellar photometers at selected New Zealand observatories to measure stellar extinction are outlined. ESA

N78-17611# World Meteorological Organization, Geneva (Switzerland).
A LOW COST METEOROLOGICAL DATA LOGGING SYSTEM FOR REMOTE SITES
P. J. Edwards and A. J. Roxburgh *In its* Instr. and Methods of Observation 1977 p 153-158 refs (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

A simple and economic general purpose data recording and data retrieval system is described. The two main features are: (1) data are recorded in the time domain such that the frequency period and/or times of occurrence of recorded pulses are related to the physical measurements in a direct manner; (2) data are recorded in a simple format so that data retrieval options are restricted as little as possible. ESA

N78-17612# World Meteorological Organization, Geneva (Switzerland).
MEASUREMENT OF ATMOSPHERIC METEOROLOGICAL PARAMETERS USING ACOUSTIC RADARS [MESURES DES PARAMETRES METEOROLOGIQUES DE L'ATMOSPHERE AU MOYEN D'UN RADAR ACOUSTIQUE]
P. Ravussin *In its* Instr. and Methods of Observation 1977 p 159-164 refs In FRENCH (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

A remote sensor for measuring the principal meteorological parameters of the atmosphere such as the three dimensional wind, the temperature and humidity, as well as the turbulence using acoustic wave reflection on the atmosphere layers is presented. Its operational principles are outlined. ESA

N78-17613# World Meteorological Organization, Geneva (Switzerland).
SYSTEM FOR THE LOW TROPOSPHERE SOUNDING OF THE SWISS INSTITUTE OF METEOROLOGY [SYSTEME DE SONDAGE DANS LA BASSE TROPOSPHERE DE L'INSTITUT SUISSE DE METEOROLOGIE]
P. Wasserfallen and P. DuPasquier *In its* Instr. and Methods of Observation 1977 p 165-167 In FRENCH (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

A system for acquisition and processing of the atmospheric temperature, humidity, wind velocity and direction, and the atmospheric pressure data is decribed. The calibration of this system is explained and future perspectives presented. ESA

N78-17614# World Meteorological Organization, Geneva (Switzerland).
AN INSTRUMENT TO MEASURE THE AEROSOL CONCENTRATION IN THE ATMOSPHERE
K. H. Kaeselau *In its* Instr. and Methods of Observation 1977 p 168-172 refs Sponsored by Deut. Forschungsgemeinschaft (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

An investigation of Aitken nuclei in the troposphere and stratosphere is described. The measuring equipment consisted of a balloon-borne AN-counter based on the principle of Wilson's cloud chamber which automatically samples the air for its content of aerosols smaller than about 0.1 microm in radius and records them on photographic film. ESA

N78-17615# World Meteorological Organization, Geneva (Switzerland).
DESIGN AND PERFORMANCE OF A NEW INSTRUMENT FOR MEASURING UV-B GLOBAL RADIATION
K. Dehne *In its* Instr. and Methods of Observation 1977 p 173-178 refs (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

The basic principle of the UV-B measuring instrument is the simulation of the most effective part of the spectral efficiency curve for minimal erythema by the spectral transmittance of a special interference filter. The filtered radiation is detected by a photomultiplier tube having the maximum of spectral response near the UV-B range. The instrument and its calibration is described and details of its performance are presented. ESA

N78-17616# World Meteorological Organization, Geneva (Switzerland).
AN EVALUATION OF MTI TECHNIQUE FOR GROUND CLUTTER REJECTION
Jiro Aoyagi and Nobuhiko Kodaira *In its* Instr. and Methods of Observation 1977 p 179-184 refs (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

An automatic signal processing system for the short period rainfall prediction in addition to the real time radar data monitoring is described. In order to distinguish the weather as precipitation echoes from interferences such as ground clutter the noncoherent moving target indicator technique is used making it possible to extract the quantitative rainfall rate with the knowledge of the probability distribution of received signals. The characteristics and responses of the equipment are given. ESA

N78-17617# World Meteorological Organization, Geneva (Switzerland).
OPERATIONAL EXPERIENCE WITH DRY AND WET CHEMICAL TYPE INSTRUMENTS TO MEASURE OZONE NEAR THE GROUND
W. Attmannspacher, R. Hartmannsgruber, and D. Hans *In its* Instr. and Methods of Observation 1977 p 185-190 refs (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

Mean monthly ozone values for the period January/February 1976 to March 1977 for two different types of sensors are presented. The instruments were a chemiluminescent sensor using ethylenegas and a wet chemical sensor with a sulfur dioxide filter, based on chromium trioxide and sulfuric acid. The influence of sulfur dioxide gas on the wet chemical sensor and the influence of the relative air humidity on both types is noted. ESA

N78-17618# World Meteorological Organization, Geneva (Switzerland).
AUTOMATIC ANALYSER FOR PH AND ELECTRICAL CONDUCTIVITY OF PRECIPITATION
Peter Winkler *In its* Instr. and Methods of Observation 1977 p 191-196 refs (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

An automatic precipitation analyzer developed to measure pH and electrical conductivity in situ during a precipitation event is described. The funnel is closed by a motor driven cover during periods of instant rain. When precipitation falls, a rain sensor activates the motor which opens the cover. From the funnel the rain enters the conductivity cell and passes the pH probe. The reasons for this arrangement are outlined and measurements with the device are presented and compared with a conventional rain gage. ESA

N78-17619# World Meteorological Organization, Geneva (Switzerland).
SURVEY OF UPPER WINDFINDING EQUIPMENT DEVELOPED IN FINLAND WITH SPECIAL REFERENCE TO OMEGA-BASED SYSTEMS
Eero Puhakka *In its* Instr. and Methods of Observation 1977 p 197-201 (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

The development of upper windfinding equipment consisting of a radio theodolite for tracking signals of a 25 MHz radiosonde is described. The theodolite and also sonde are briefly described and their incorporation into CORA - a windfinding system utilizing VLF navigational and networks such as OMEGA. ESA

N78-17620# World Meteorological Organization, Geneva (Switzerland).
RADAR MEASUREMENTS OF PRECIPITATION
C. G. Collier *In its* Instr. and Methods of Observation 1977 p 202-207 refs (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

A brief summary of the basic results from an experiment using a C band radar to measure precipitation is presented. Factors influencing the accuracy of measurements are given and a comparison of radar and rain gage estimates of areal rainfall is made. Comparisons between the accuracy of surface rainfall measurements by calibrated radar and rain gage network of varying densities are also given. ESA

N78-17621# World Meteorological Organization, Geneva (Switzerland).
AN INTERCOMPARISON OF RADIATION SHIELDS FOR AUTO STATIONS
D. J. McKay and J. D. McTaggart-Cowan *In its* Instr. and Methods of Observation 1977 p 208-213 refs (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

The qualities of some 19 sensors and shields for use as radiation shielding in automatic weather stations are compared and assessed for given situations. Several types of data analysis were used to evaluate the shields but the best method was that of producing histograms of the errors in hourly values. ESA

N78-17622# World Meteorological Organization, Geneva (Switzerland).
MINI METEOROLOGICAL DIRIGIBLE FOR THE SURVEILLANCE AND STUDY OF LOW LAYERS [PROJET DE MINI-DIRIGEABLE METEOROLOGIQUE POUR LA SURVEILLANCE ET L'ETUDE DES BASSES COUCHES]
Claude Besson, Nadine Cenac, Daniel Martin, Jean-Paul Meyer, Christian Rebotier, and Marcel Zephoris *In its* Instr. and Methods of Observation 1977 p 214-219 In FRENCH (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

A mini-dirigible for the remote surveillance and investigation of low atmosphere is described. It will give information on aerology, cloud physics, as well as the atmospheric pollution. Two types of measurements are foreseen: (1) in-situ measurements on the vertical distribution and physico-chemical evolution of the various minor constituents; and (2) remote measurements to establish air pollution maps. ESA

N78-17623# World Meteorological Organization, Geneva (Switzerland).
OPERATIONAL EXPERIENCE WITH OMBROMETER HP MEASUREMENTS OVER A PERIOD OF SEVERAL YEARS
W. Attmannspacher *In its* Instr. and Methods of Observation 1977 p 220-225 refs (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

The results of an intercomparison of 24 hourly precipitation amounts over a period of five years (January 1972 to December 1976) between an ombrometer HP and a normal Hellmann rain gage measuring rain, rain and snow, and snow are presented. Short time precipitation intensities are given, and it is concluded that the ombrometer showed realistic data, not influenced by fog droplets and with little change in calibration. ESA

N78-17624# World Meteorological Organization, Geneva (Switzerland).
AIRCRAFT TO SATELLITE DATA RELAY (ASDAR)
J. Sparkman and J. Giraytys *In its* Instr. and Methods of Observation 1977 p 226-230 (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

In-flight acquisition of meteorological data by commercial aircraft has been carried out for some time. A system whereby this data is collected by satellite in real time is described. Known as ASDAR (Aircraft to Satellite Data Relay) the system can store up to 8 weather samples (taken at 7.5 minute intervals by the aircraft). Hourly, the eight reports are sent to a geostationary satellite. Thereby aircraft can report over one satellite channel each hour. Preliminary results of the system are described. ESA

N78-17625# World Meteorological Organization, Geneva (Switzerland).
AQUASONDE: A GAGE FOR THE VERTICAL DISTRIBUTION OF THE DIMENSIONAL SPECTRUM OF CLOUD DROPS [L'AQUASONDE: SONDE FOURNISSANT LE SPECTRE DIMENSIONNEL DES GOUTTES DE NUAGES SUIVANT UNE COUPE VERTICALE]
Vladislav Klaus and Jean-Louis Champeaux *In its* Instr. and Methods of Observation 1977 p 231-236 In FRENCH (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

The dropsonde to determine the vertical distribution and the dimensional spectrum of cloud drops from 10 to 100 microns is described. This instrument to be used on aircraft includes a granulometry sensor, a pressure sensor and a transmitter. The FM signals are real time processed. ESA

N78-17626# World Meteorological Organization, Geneva (Switzerland).
SNOW GAUGE FOR AUTOMATIC WEATHER STATIONS
S. Klemm, H. Henning, and U. Bleek *In its* Instr. and Methods of Observation 1977 p 237-241 refs (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

The five main principles for the measurement of snowfall are summarized. Basically these consist of the application of the Hellmann rain gage with funnel heating; water content measurement of the snow cover by a radioactive method; snow measurement by chemical solvents; water content measurement of snow cover by a pressure snow pillow and snow measurement by an electronically controlled heating system. A description of the rain gage in use at automatic weather stations in East Germany for measuring snowfall is given. ESA

N78-17627# World Meteorological Organization, Geneva (Switzerland).
AN ELECTRONIC MONITOR FOR MEASURING ATMOSPHERIC TURBULENCE
T. C. Berg and B. Sivertsen *In its* Instr. and Methods of Observation 1977 p 242-248 refs (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

An electronic monitor for measuring atmospheric turbulence parameters is described. The system is digitized and output signals from the monitor are logged every five minutes on a magnetic tape data logger. Results of wind velocity and direction measurements using the device are presented. ESA

N78-17628# World Meteorological Organization, Geneva (Switzerland).
THE POSSIBILITY OF ACDAR TO MEASURE IN REAL TIME THE HEIGHT OF THERMAL INVERSIONS [APTITUDE DE L'ACDAR A MESURER EN CONTINU LES HAUTEURS D'INVERSION]
A. VanGysegem and H. Hellemans *In its* Instr. and Methods of Observation 1977 p 249-254 In FRENCH (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

The operational principles of the ACDAR are presented. The ACDAR emits a short acoustic pulse in the atmosphere and measures the resulting echo; the echo being produced by temperature and wind variations at the atmospheric layer interfaced such as the height of a temperature inversion. The height of temperature inversions obtained using the ACDAR is compared to values determined by a radiosonde. The high performance of ACDAR is emphasized. ESA

N78-17629# World Meteorological Organization, Geneva (Switzerland).
WEATHER RADAR REMOTING
Eric J. Bell *In its* Instr. and Methods of Observation 1977 p 255-260 (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

The advantages and applications of weather radar and its use in assisting the meteorologist are reviewed. Some radar fundamentals are given together with information on processing, transmission, and display of radar data. Equipment developed for radar remoting interfaces directly with radar video data and converts the information into a form suitable for real time transmission over a telephone line to a remote receiving station. ESA

N78-17630# World Meteorological Organization, Geneva (Switzerland).
LOW-POWER MICROCOMPUTER-AWS
Jan Hoerhammaer *In its* Instr. and Methods of Observation 1977 p 261-264 (For availability see N78-17580 08-47)
Avail: NTIS HC A12/MF A01

A small, compact automatic weather station able to handle basic meteorological sensors, carry out the relevant calculations, store data for later evaluation, and transmit data on request to remote terminals is described. The different units making up the station are reviewed together with the types of sensors. ESA

N78-17631# Air Weather Service, Scott AFB, Ill.
TRANSNORMALIZED REGRESSION PROBABILITY Final Report
Albert R. Boehm Dec. 1976 54 p refs
(AD-A047720; AWS-TR-75-259) Avail: NTIS MF A01 CSCL 04/2

The Transnormalized Regression Probability (TRP) model uses climatological probabilities and requires only a relatively small data base to calculate the probability of occurrence of a future weather event. The three main procedures that comprise this multivariate transnormalized method are: transnormalization, correlation, and regression conditional probability. The transnormalization process, a nonlinear process, transforms the observed or raw data into the standard normal variable with the same cumulative climatological probability as the raw predictor. Transnormalization insures that the predictor is normally distributed. The correlation step involves finding the simple correlation between each pair of transnormalized variables. The regression coefficients are calculated using the same steps involved in ordinary multiple linear regression. Conditional probability is calculated using the transnormalized variables in the multivariate normal distribution. Author (GRA)

N78-17632# Naval Weather Service Detachment, Asheville, N. C.
GUIDE TO STANDARD WEATHER SUMMARIES AND CLIMATIC SERVICES
J. W. Ownbey Jan. 1978 198 p
(AD-A047482; NAVAIR-50-IC-534) Avail: NTIS HC A09/MF A01 CSCL 04/2

This publication provides a description of published and unpublished climatological summaries available from the climatic complex in Asheville, N. C. It also includes a catalogue of the available summaries on a world-wide basis in continent-country-station order. Author (GRA)

N78-17633# Air Force Geophysics Lab., Hanscom AFB, Mass.
DISPERSAL OF SUPERCOOLED STRATUS CLOUDS BY SILVER IODIDE SEEDING Interim Report
Rosemary M. Dyer, John R. Thompson (North American Weather Consultants, Goleta, Calif.), and Chester Wisner (North American Weather Consultants, Goleta, Calif.) 27 Oct. 1977 5 p refs Presented at the 6th Conf. on Plant and Inadvertent Weather Modification, 10-13 Oct. 1977, Urbana, Ill.
(AD-A047338; AFGL-TR-77-0234) Avail: NTIS HC A02/MF A01 CSCL 04/2

During February 1977, a field program was conducted in

northern Michigan to determine the feasibility of using silver iodide flares to make clearings in supercooled stratus decks over pre-selected ground locations. Targeting of the clearings was always possible if an accurate measurement of the wind at cloud height were available. The temperature in the upper portion of the cloud is apparently the critical meteorological parameter. On no occasion was a clearing effected when the cloud-top temperature was -6 degrees C or warmer; however clearing did occur when cloud base temperature was as warm as -3 degrees C. Author (GRA)

N78-17634# Environmental Research and Technology, Inc., Concord, Mass.

STRATOSPHERIC TURBULENCE ANALYSIS Final Report, 1 Jan. - 31 Aug. 1977

Robert K. Crane Sep. 1977 149 p refs

(Contract F19628-77-C-0059)

(AD-A047740; AFGL-TR-77-0207) Avail: NTIS HC A07/MF A01 CSCL 04/2

A model was developed to combine radiosonde observations with ultrasensitive well-calibrated radar measurements of clear air turbulence to provide estimates of two eddy parameters, the eddy dissipation rate and the eddy heat diffusion coefficient. The eddy parameters were obtained as volume averages over 1 km thick layers and time averages over several hours. The model was tested using simultaneously obtained radar measurements and pilot reports of turbulence intensity from a U-2 aircraft. The model was also shown to be consistent with other reported radar and aircraft measurements. Author (GRA)

N78-17635# Naval Ship Research and Development Center, Bethesda, Md. Ship Performance Dept.

A SURVEY OF WIND LOADS ON OCEAN FACILITY STRUCTURES

N. T. Tsai Aug. 1977 56 p refs

(AD-A047800; SPD-716-01) Avail: NTIS HC A04/MF A01 CSCL 04/2

A survey was conducted to compile and annotate the existing wind loads data applicable to ocean facilities structures, including ships, moored systems and offshore structures. After a survey of sources available at the David W. Taylor Naval Ship Research and Development Center (DTNSRDC), a bibliography on wind loads data was prepared. Data item summary sheets are given for representative wind loads data, including typical analytical methods and representative experimental methods. The survey revealed that there is a lack of wind loads data on offshore structures and that a handbook on the wind loads on ocean facilities structures is needed for ocean engineering applications. This handbook could be part of a handbook on environmental forces which could include wind, wave and current loads on ocean structures. Author (GRA)

N78-17636# National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Resources Labs.

A MESOSCALE TRANSPORT AND DIFFUSION MODEL

Roland R. Draxler Jun. 1977 38 p refs

(PB-273919/1; NOAA-TM-ERL-ARL-64; NOAA-77092904) Avail: NTIS HC A03/MF A01 CSCL 04B

A mesoscale Lagrangian trajectory transport and diffusion model was developed which takes into account stability changes along the trajectory. The required input data for trajectory computations are hourly surface meteorological observations and standard upper air observations. A one dimensional finite difference model for vertical diffusion and deposition was used in the calculations with each trajectory. The vertical mixing coefficient is based upon the Pasquill stability at each trajectory segment. Dry deposition and washout were calculated if required. The transport layer, that layer containing 90% of the mass as calculated by the finite difference method, grows with time along the trajectory. Air concentrations were calculated for specified sampling periods at selected receptor locations. Author

N78-17637# National Oceanic and Atmospheric Administration, Washington, D. C. Environmental Data Service.

MARINERS WEATHER LOG. VOLUME 21, NUMBER 5, SEPTEMBER 1977

Elwyn E. Wilson, ed. Jul. 1977 65 p refs

(PB-273688/2; NOAA-77100101) Avail: NTIS HC A04/MF A01 CSCL 04B

A group of four articles are provided which include a description of the Port Valdez, Alaska, weather station; a report on a sailing competition for the America Cup, reports of sea temperature and observations of a North Pacific storm. B.L.P.

N78-17638# South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.

EVALUATION OF MILES CITY SWR-75 WEATHER RADAR

P. L. Smith Apr. 1977 63 p refs Sponsored in part by Bureau of Reclamation, Denver

(PB-274023/1; Rept-77-1) Avail: NTIS HC A04/MF A01 CSCL 04B

The results of an evaluation of the SWR-75 C-band weather radar system located at Miles City, Montana are presented. The evaluation procedures are described in some detail and the results of the measurements given. Recommendations for changes or improvements in the system and the calibration and operating procedures are presented. The overall conclusion of the evaluation was that the SWR-75 system and the calibration procedures in use conform for the most part to currently accepted practice in the weather radar field. No basis was found for expecting substantial errors in C-band equivalent radar reflectivity factors measured with the SWR-75. GRA

N78-17639# Bureau of Reclamation, Denver, Colo. Div. of Atmospheric Water Resources Management.

COST-EFFECTIVE ELECTRIC POWER GENERATION FROM THE WIND

C. J. Todd, R. L. Eddy, R. C. James, and W. E. Howell Aug. 1977 34 p refs Presented at The Intern. Solar Energy Soc., Orlando, Fla., 6-10 Jun. 1977

(PB-273582/7) Avail: NTIS HC A03/MF A01 CSCL 10B

The idea of generating windpower at the windiest available sites (wind farms) was examined for its effect on feasibility of large-scale windpower input to the nationwide electric power network. Windpower was considered in association with pumped-storage hydroelectric plants for load leveling and existing types of transmission lines for interconnecting the wind farms and energy storage sites with load centers up to 2000 km away. Potential energy harvest from wind farm sites in the 17 Western States was estimated at well over 100 GW, and many times this much in arctic North America. At the 100-GW level of development bus bar cost at the wind farm would be 3 mills/MJ (10 mills/kWh). GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N78-17640*# Texas A&M Univ., College Station. Center for Marine Resources.

SCIENTIFIC INVESTIGATIONS IN THE GULF OF MEXICO AND CARIBBEAN SEA DURING THE 1974-1975 CALYPSO CRUISE, PARTS 1 AND 2 Final Report, Nov. 1974 - Dec. 1975

S. Z. ElSayed, H. Abdel Reheim, G. A. Fryxell, J. C. Harlan, J. M. Hill, P. Babai, and P. Whitney 31 Dec. 1975 262 p refs

(Contract NAS5-20877)

(NASA-CR-156688) Avail: NTIS HC A12/MF A01 CSCL 08J

The distribution and concentrations of the standing crop of phytoplankton and nutrient salts in the Gulf of Mexico and the Caribbean Sea were investigated to provide ground truth for correlating temperature and chloraphyll-a measurements with observations from NASA U-2 aircraft equipped with specially designed sensors for measuring ocean color phenomena. The physical, chemical, and biological data obtained are summarized. Sampling procedures and methods used for determining plant pigments, species composition of phytoplankton, nutrient salt analysis, and the euphotic zones are described. Author

N78-17641# Lockheed Missiles and Space Co., Palo Alto, Calif.

VERTICAL STRUCTURE OF TEMPERATURE AND FLOW VELOCITY FLUCTUATIONS. SOME QUESTIONS OF AN EXPERIMENT IN THE UPPER OCEAN LAYER

V. V. Navrotskii [1978] 9 p refs Transl. into ENGLISH from Okeanologicheskie Issled. (Moscow), no. 28, 1975 p 29-35
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Temperatures were observed in three-dimensional layers by using a thermosweep, as were the flow temperatures and velocities on buoy stations during different expeditions in the Atlantic Ocean. Results of analysis of these observations, referring to the vertical structure of the medium scale fluctuations in a layer to 200 m are elucidated briefly in this paper, and the nearest problems of experimental investigations of the upper ocean layer are discussed. Author

N78-17642# Rosenstiel School of Marine and Atmospheric Sciences, Miami, Fla. Dept. of Physical Oceanography.
WIND-FORCED EQUATORIAL WAVES IN THE ATLANTIC OCEAN Ph.D. Thesis
Zachariah R. Hallock May 1977 164 p refs
(Contract N00014-75-C-0173)
(AD-A040829; TR-77-2) Avail: NTIS HC A08/MF A01 CSCL 08/3

During the GARP Atlantic Tropical Experiment (GATE), north-south fluctuations in the equatorial current system were observed. Observations of current profiles during Phase 2 suggest that the fluctuations had a period of about 16 days and were propagating westward with a phase speed of 130 to 190 cm/sec. Evidence of fluctuations in the tradewinds at similar frequencies was also found. Analysis of profiling current meter (PCM) data reveals that latitudinal shear in the zonal equatorial currents is important, and that meridional and vertical motions are highly time-dependent and have small means. Theoretical analysis of a linear, two-layer system shows that the characteristics of the observed fluctuations are consistent with the theory of linear, equatorially trapped waves, particularly the Yanai wave. Numerical integration of equations of this system shows that oscillations such as those observed may be a resonant response to an impulsive, cross-equatorial forcing in the upper layer. The presence of a mean zonal flow with shear modifies but does not drastically alter, the results. Author (GRA)

N78-17643# Naval Postgraduate School, Monterey, Calif. Experimental Physics Group.
ALTITUDE DEPENDENCE OF C SUB T2 OVER THE OCEAN Report, Sep. 1976 - Jun. 1977
C. W. Fairall, Ralph Markson (Airborne Res. Associates), and Jan Sedlacek (Airborne Res. Associates) 1 Oct. 1977 34 p refs
(Contract N00019-76-C-0588)
(AD-A045609; NPS-61FR77101) Avail: NTIS HC A03/MF A01 CSCL 08/10

The height dependence of the temperature structure parameter was measured with microthermal sensors mounted on a light aircraft. This work was done in conjunction with optical propagation and turbulent transport research in the marine boundary layer. These measurements indicate that, in the absence of a strong inversion, the constant stress layer can be surprisingly thin. The measurements also substantiate the strong role played by temperature and water vapor discontinuities in turbulence above the boundary layer. Author (GRA)

N78-17644# Naval Research Lab., Washington, D. C.
MEASUREMENT OF THE ACOUSTIC IMPEDANCE OF THE OCEAN BOTTOM Final Report
W. James Trott Sep. 1977 10 p refs
(RR0110842)
(AD-A047819; AD-E000028; NRL-MR-3601) Avail: NTIS HC A02/MF A01 CSCL 08/10

Transducer circuit theory is used to derive a means for measuring the impedance of a locally reacting surface. A directional source, linear or parametric, insonifies a finite area in a reference plane at which the impedance is specified. Computer programs are referenced for calculating the required diffraction constants and radiation impedance for the test geometry. Author (GRA)

N78-17645# Danish Meteorological Inst., Copenhagen.
MONTHLY SURFACE TEMPERATURES OF THE NORTHERN ATLANTIC - 50-80 DEG N, 0-60 DEG W, 1974
1977 28 p In DANISH; ENGLISH summary
(ISBN-87-7478-146-4) Avail: NTIS HC A03/MF A01

Tables are given for the North Atlantic containing: the average of ship observed, sea surface temperatures for each month of 1974 and the number of observations. ESA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N78-17646 Temple Univ., Philadelphia, Pa.
EFFECTS OF ENDURANCE TRAINING ON LEFT VENTRICULAR FUNCTION IN THE DOG: A CINEANGIOGRAPHIC STUDY Ph.D. Thesis
Theodore Frank Ritzer 1977 303 p
Avail: Univ. Microfilms Order No. 77-21839

The effects of endurance training on in vivo function and dimensions of the left ventricle (LV) were investigated using biplane cineangiographic techniques. Group 1, consisting of seven dogs, underwent aseptic surgery during which a pressure transducer was placed in the LV via an apical puncture wound. Group 2, consisting of three dogs, were sham operated and served as controls. The heart rate response to exercise on a treadmill was evaluated in both groups after four weeks and the dogs were angiographically studied. Results indicated that while the LV surgery did not affect the physical work capacity in group 1, it did depress their LV performance. No significant differences in angiographically determined LV mass or midventricular end diastolic wall thickness were found between the groups. It was concluded that the LV adapts to the intermittent volume load of chronic endurance training as much it would adapt to other forms of compensated morphologically induced volume loads. Dissert. Abstr.

N78-17647*# National Aeronautics and Space Administration, Washington, D. C.
PUBLICATIONS OF THE SPACE BIOLOGY PROGRAM FOR 1975-1977: A SPECIAL BIBLIOGRAPHY
J. C. Felt, comp. and T. W. Halstead, comp. Jan. 1978 26 p
(NASA-TM-79324) Avail: NTIS HC A03/MF A01 CSCL 06C

Documents cited represent research encompassing several disciplines of space biology: botany and plant pathology, physiology and biophysics, agricultural and environmental sciences, anatomy and embryology, cellular and comparative biology, horticulture and aerospace biology. M.V.

N78-17648*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
MICROBIAL LOAD MONITOR
R. S. Caplin and E. R. Royer 1 Feb. 1978 16 p refs
(Contract NAS9-11877)
(NASA-CR-151623; MDC-E1822) Avail: NTIS HC A02/MF A01 CSCL 06C

Attempts are made to provide a total design of a Microbial Load Monitor (MLM) system flight engineering model. Activities include assembly and testing of Sample Receiving and Card Loading Devices (SRCLDs), operator related software, and testing of biological samples in the MLM. Progress was made in assembling SRCLDs with minimal leaks and which operate reliably in the Sample Loading System. Seven operator commands are used to control various aspects of the MLM such as calibrating and reading the incubating reading head, setting the clock and reading time, and status of Card. Testing of the instrument, both in hardware and biologically, was performed. Hardware testing concentrated on SRCLDs. Biological testing covered 66 clinical and seeded samples. Tentative thresholds were set and media performance listed. Author

N78-17102*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ZONE-FORMING FUNGI: EXPERIMENT MA-147
T. D. Rogers (Northrop Services, Inc., Houston, Tex.), M. E. Brower (Northrop Services, Inc., Houston, Tex.), and G. R. Taylor *In its* Apollo-Soyuz Test Proj., Vol. 1 1977 p 227-236 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 06C

N78-17103*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MICROBIAL EXCHANGE: EXPERIMENT AR-002
G. R. Taylor, K. D. Kropp (Northrop Services, Inc., Houston, Tex.), M. R. Henney (Northrop Services, Inc., Houston, Tex.), S. S. Ekblad (Northrop Services, Inc., Houston, Tex.), A. A. Baky (Northrop Services, Inc., Houston, Tex.), T. O. Groves (Northrop Services, Inc., Houston, Tex.), T. C. Molina (Northrop Services, Inc., Houston, Tex.), J. G. Decelle (Northrop Services,Inc., Houston, Tex.), C. F. Carmichael (Northrop Services, Inc., Houston, Tex.), N. J. Gehring (Northrop Services, Inc., Houston, Tex.) et al *In its* Apollo-Soyuz Test Proj., Vol. 1 1977 p 237-255 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 06C

N78-17106*# Baylor Univ., Waco, Tex. College of Medicine.
KILLFISH HATCHING AND ORIENTATION: EXPERIMENT MA-161
H. W. Scheld, A. A. Baky (Northrop Services, Inc., Houston, Tex.), J. F. Boyd (Northrop Services, Inc., Houston, Tex.), V. B. Eichler (Wichita State Univ., Kas.), P. M. Fuller (Louisville Univ., Ky.), R. B. Hoffman, J. R. Keefe (Louisville Univ., Ky.), K. P. Kuchnow (Texas A. and M. Univ., College Station), J. M. Oppenheimer (Bryn Mawr College, Pa.), G. A. Salinas (Northrop Services, Inc., Houston, Tex.) et al *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 281-305 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 06C

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N78-17649 Iowa State Univ. of Science and Technology, Ames.
THE EFFECTS OF MALDISTRIBUTION ON THE UPTAKE AND DISTRIBUTION OF INERT GASES IN THE HUMAN LUNG Ph.D. Thesis
Ferruh Erturk 1977 129 p
Avail: Univ. Microfilms Order No. 77-25981

Mathematical models to describe the effect of the maldistribution of ventilation perfusion ratios in the human lung were developed for two new noninvasive measuring techniques. The two techniques, which employed sinusoidal and stepwise inert gas concentration forcing functions were tested simultaneously on healthy human subjects. The results show a one-compartment homogeneous lung model describes the normal lung satisfactorily. In the frequency-response method, halothane was used as the inert gas agent. In the step method, five inert gases ranging from very low solubility (helium) to very high solubility (acetone) were used with halothane, V/Q ratios of approximately unity were obtained from both methods. Ether and acetone show abnormally high V/Q ratios due to absorption in higher airways. Presence of an equivalent dead-space can be depicted.
Dissert. Abstr.

N78-17650 Stanford Univ., Calif.
TOTALLY IMPLANTABLE BIDIRECTIONAL PULSED DOPPLER BLOOD FLOW TELEMETRY: INTEGRATED TIMER-EXCITER CIRCUITRY AND DOPPLER FREQUENCY ESTIMATION Ph.D. Thesis
Henry Vandegrift Allen 1977 180 p
Avail: Univ. Microfilms Order No. 77-25639

A totally implantable directional pulsed Doppler blood flowmeter is disclosed that resolves problems of baseline and scale factor drift. The device is based on two custom designed integrated circuits and measures 2.9 x 3.8 x 0.8 cm, the smallest implantable flowmeter realized to date. The design of portions of the system intended for long term implantation in chronic animal research is described. Dissert. Abstr.

N78-17651 Stanford Univ., Calif.
A NONLINEAR MODEL OF THE HUMAN EEG SIGNAL DURING PHOTIC STIMULATION Ph.D. Thesis
John Richard Nickolls 1977 223 p
Avail: Univ. Microfilms Order No. 77-25708

The human electroencephalogram (EEG) exhibited many complex and poorly understood responses to stroboscopic flashes and other uniform field photo stimulation. A class of phenomena involving photic stimulation and the EEG alpha rhythm was characterized in terms of the simplest nonlinear input-output model exhibiting these phenomena. Quantitative testing and evaluation of the characterization were achieved with digital model stimulations and experimental EEG data. The fit was particularly good for periodic stimuli and extended over a wide range of frequencies. The model was consistent with what is known about the physiology of alpha wave generation, and unified several apparently disparate phenomena with one nonlinear mechanism. It also suggested an unusual sampled-data structure for the relationships between saccadic eye movements, EEG alpha activity, cortical excitability, and visual perception. Dissert. Abstr.

N78-17652 Wisconsin Univ., Madison.
VENTILATION-PERFUSION RATIO DISTRIBUTIONS FROM MULTIPLE INERT-GAS ELIMINATION DATA: MASS-SPECTROMETER MEASUREMENT AND NONLINEAR PARAMETER ESTIMATION Ph.D. Thesis
Samuel Martin Mastenbrook, Jr. 1977 173 p
Avail: Univ. Microfilms Order No. 77-19721

A sensitive and versatile quadrupole mass spectrometer system was constructed as a alternative to the gas chromatography technique for measuring multiple inert gas elimination at trace concentrations. A number of gases were investigated for this application, and a set of six was selected that is compatible with both ventilation-perfusion distribution theory and quadrupole mass spectrometer characteristics. Dissert. Abstr.

N78-17653 Kansas Univ., Lawrence.
A COMPUTER BASED MEDICAL ULTRASOUND B-SCAN SYSTEM Ph.D. Thesis
Jonathan Ophir 1977 307 p
Avail: Univ. Microfilms Order No. 77-28900

A computer based medical ultrasound B-scan system was designed, constructed and made operational. The system accomplishes three objectives: (1) to acquire, process, and display wide amplitude dynamic range echo signals in real time; (2) to establish a flexible hardware-software research system to be used to learn how best to present ultrasonic data to a physician for improved medical diagnosis; and (3) to reduce the dependence of ultrasound images on scanning technique and on machine settings. Ultrasound echoes are acquired from a patient, digitized and transferred to a computer via a sampling interface. After appropriate software manipulation of the echo data to remove its dependence on machine settings, it is processed and displayed as a brightness modulated image with 128 x 128 resolution cells and up to 15 gray levels. Dissert. Abstr.

N78-17654 Texas Univ., Austin.
THE EFFECTS OF BURN INJURY AND POST BURN COOLING IN THE MICROCIRCULATION Ph.D. Thesis
Donald Charles Ross 1977 118 p
Avail: Univ. Microfilms Order No. 77-29085

Tests were performed on over 200 hamster cheek pouch preparations in which standard burns of various temperatures and durations were created to produce predictable impairment of blood flow in the localized microvasculature. Subsequently, after a delay period of 10 minutes, the temperature of the tissue at the burn site was reduced to a value between 3 C and 25 C for either 5, 30, or 60 minutes and the recovery of circulatory function measured. The level of activity in the blood vessel was assessed by visual monitoring for 2 hours subsequent to termination of cooling therapy. It was observed that, in general, flow returned first to capillaries followed by veinules and arteries. For each duration of cooling an optimum temperature was identified which yielded a maximum recovery of flow to the occluded vessels. The most effective cooling therapy is with short initiation delays and long cooling intervals. Dissert. Abstr.

N78-17655*+ National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 177
Feb. 1978 42 p
(NASA-SP-7011(177)) Avail: NTIS HC E02 CSCL 06E

This bibliography lists 112 reports, articles, and other documents introduced into the NASA scientific and technical information system in January 1978. Author

N78-17656# Civil Aeromedical Inst., Oklahoma City, Okla.
THE ROLE OF MONAMINE OXIDASE INHIBITION IN THE ACUTE TOXICITY OF CHLORDIMEFORM
Paul W. Smith (Oklahoma Univ., Oklahoma City), Casey P. Robinson, Jane D. Zelenski (Oklahoma Univ., Oklahoma City), and Boyd R. Endecott Aug. 1977 13 p refs
(AD-A045507; FAA-AM-77-19) Avail: NTIS HC A02/MF A01 CSCL 06/15

Data from experiments on male rats are presented to determine whether drugs which interfere with central amine mechanisms would decrease the lethality of the acaricide chlordimeform or increase chlordimeform lethality. Neither reducing serotonin synthesis with p-chlorophenylalanine, reducing norepinephrine synthesis with DL-alpha-methyl-p-tyrosine nor depleting both amines with reserpine affected the lethality of chlordimeform. Blocking alpha-adrenergic receptors with phentolamine or the serotonergic receptors with methysergide, or both, did not influence chlordimeform lethality. The adrenergic agonist drug phenylephrine also did not affect chlordimeform lethality. Thus, the results indicate that: (1) monamine oxidase inhibition does not play a major role in acute chlordimeform lethality, (2) none of the drugs tested shows promise in the treatment of chlordimeform poisoning, and (3) aerial applicators or others would appear to incur little or no extra risk should they be taking any of the above drugs during potential exposure to chlordimeform. Author

N78-17657# Civil Aeromedical Inst., Oklahoma City, Okla.
STRESS IN AIR TRAFFIC PERSONNEL: LOW-DENSITY TOWERS AND FLIGHT SERVICE STATIONS
C. E. Melton, R. C. Smith, J. M. McKenzie, S. M. Wicks, and J. T. Saldivar Sep. 1977 19 p refs
(AD-A046826; FAA-AM-77-23) Avail: NTIS HC A02/MF A01 CSCL 05/10

Stress and anxiety levels were measured in 10 air traffic control specialists (ATCS) at two low-traffic-density towers, Fayetteville, Arkansas, and Roswell, New Mexico, and in 24 flight service (FS) specialists at Oklahoma City, Oklahoma, Fayetteville, Arkansas, and Roswell, New Mexico. Physiological measurements consisted of heart rate and urine biochemical analysis for 17 ketogenic steroids, epinephrine, and norepinephrine. On-duty arousal in ATCS's and FS specialists was evident both physiologically and psychologically; such arousal was within psychologically normal limits and was generally low physiologically compared to other air traffic control (ATC) facilities that have been studied in the past. Physiological stress levels at these low-density towers and flight service stations were also low compared to other ATC facilities that were studied previously. It is concluded that it is inappropriate to describe all air traffic control work, as is commonly done in the popular press, as unusually stressful. Such accounts in the popular press tend to deal with the exceptional rather that with the typical controller or facility. Author

N78-17658# Advisory Group for Aerospace Research and Development, Paris (France).
THE USE AND ABUSE OF SOCIAL DRUGS
Harry C. Holloway, ed. Jan. 1978 53 p refs Conf. held at Koln, West Germany, 18-22 Apr. 1977
(AGARD-CP-218) Avail: NTIS HC A04/MF A01

The conference proceedings on the use and abuse of social drugs are reported. Topics discussed include: (1) the need for drugs and alcohol programs that are unique to military organizations; (2) the influence of tobacco from a medical standpoint on French pilots; (3) the United Kingdom approach to alcoholism in air crews; (4) diagnosis of alcoholism: The Munich alcoholism test; and (5) influence of socially used drugs on vision and vision performance. For individual titles, see N78-17659 through N78-17663.

N78-17659# Walter Reed Army Inst. of Research, Washington, D.C. Dept. of Military Psychiatry.
THE NEED FOR DRUG AND ALCOHOL PROGRAMS THAT ARE UNIQUE TO MILITARY ORGANIZATIONS
Larry H. Ingraham *In* AGARD The Use and Abuse of Social Drugs Jan. 1978 6 p refs (For availability see N78-17658 08-52)
Avail: NTIS HC A04/MF A01

An epidemiological field study of illicit drug use is the basis for this study. The study used multidisciplinary methods including biochemical measures, mass questionnaire surveys, depth interviews, archival record searches, and participant observation. The details were reported elsewhere, but the themes and major findings are reviewed to understand succeeding arguments and propositions. Author

N78-17660# Ministere de l'Air, Paris (France).
THE INFLUENCE OF TOBACCO FROM A MEDICAL STANDPOINT ON FRENCH PILOTS [INFLUENCE DU TABAC DANS L'EXPERTISE MEDICALE DES FORCES AERIENNES FRANCAISES]
R. Carre, J. L. Charrieau, A. Thabaut, J. L. Durosoir, J. Hainaut, A. M. Clauzel, G. Trinquet, and A. Meyer *In* AGARD The Use and Abuse of Social Drugs Jan. 1978 10 p refs In FRENCH (For availability see N78-17658 08-52)
Avail: NTIS HC A04/MF A01

Some of the following items were discussed and analyzed in detail in reference to the influence of tobacco on the performance expertise of navigation personnel such as mechanics, pilots, and radio navigators; (1) the influence of tobacco on ventilation and pulmonary diffusion; (2) spirometric scanning; and (3) measurement of carbon monoxide transfer. Tobacco influence on the dosage of alpha 2 macroglobulin and a protamine test were examined. Results of these tests showed better evidence of vascular risks factors between smokers and nonsmokers. A statistical comparison of various protein series of pilots, smokers and nonsmokers showed significant decrease of immunoglobin G and a significant rise in the rate of alpha 1 antitrypsine and haptoglobin with smokers in comparison to nonsmokers.
Transl. by B.B.

N78-17661# Royal Air Force, Wroughton (England).
THE UK APPROACH TO ALCOHOLISM IN AIR CREW
D. N. Johnstone *In* AGARD The Use and Abuse of Social Drugs Jan. 1978 3 p (For availability see N78-17658 08-52)
Avail: NTIS HC A04/MF A01

It was determined that it is appropriate to deal with an individual as an alcoholic by reference to the World Health Organization definition. It is argued that to return to moderate use of ethanol is a desirable, and even an attainable goal for an alcoholic, however, evidence is not convincing. The risk of returning to the former level of abuse cannot be tolerated in military aviation. It is therefore demanded that total and permanent abstention be the goal of treatment. There appears to be two statistical peaks of alcoholic drinkers in UK service population; one composed of single airmen, of average age 21, and the second of married men, average 38 years. (The aircrew fall into the second group.) G.Y.

N78-17662# Deutsche Forschungsanstalt fuer Psychiatrie (Max-Planck-Institut), Munich (West Germany).
DIAGNOSIS OF ALCOHOLISM: THE MUNICH ALCOHOLISM TEST (MAT)
C. Ringer, W. Feuerlein, H. Kufner, and K. Antons *In* AGARD The Use and Abuse of Social Drugs Jan. 1978 8 p (For availability see N78-17658 08-52)
Avail: NTIS HC A04/MF A01

A diagnostic instrument which would permit sufficiently reliable differentiation between alcoholics and healthy as well as sick persons was developed, and empirically tested. For this purpose roughly 250 diagnostically relevant items were selected from the extensive literature on alcoholism and in three separate phases with a total of 1335 patients evaluated for their ability to differentiate. The best items were selected on the basis of various statistical criteria and then cross validated. The result is the Munich Alcoholism Test, which consists of two complementary parts; a seven item physician's assessment part, and a 24 item self assessment part. Author

N78-17663# California Univ., Berkeley.
INFLUENCE OF SOCIALLY USED DRUGS ON VISION AND VISION PERFORMANCE

A. J. Adams, E Brown, M. C. Flom, A. Jampolsky, and R. T. Jones *In* AGARD The Use and Abuse of Social Drugs Jan. 1978 8 p refs (For availability see N78-17658 08-52)
Avail: NTIS HC A04/MF A01

In a four-year study on vision and vision performance the drug and placebo treatments were administered double blind using replicated, balanced Latin Square design. The major oculomotor findings are (1) an increase in tonic convergence, (2) the maximum velocity of smooth eye tracking is decreased by alcohol and not by marijuana, (3) optokinetic nystagmus and peripheral gaze nystagmus are affected by both drugs but more by alcohol, (4) pupil size is reduced by marijuana and unaffected by alcohol. The major visual sensory findings are (1) no change in visual acuity with either drug, (2) a marked reduction in the acuity of moving objects by alcohol and to a lesser extent by marijuana, (3) a prolonged glare recovery associated with either drug, (4) small reduction in color discrimination similar to those seen in mild protonomaly, and (5) a decrease in visual search time for alcohol but not for marijuana. In general combined doses of alcohol and marijuana failed to support a simple additive model for drug activity. All observed changes reached a maximum within 2 hours, and lasted for up to 6 hours after drug ingestion, and most of the changes are dose related. Author

N78-17664*# Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. Dept. of Physiology.
SPECIALIZED PHYSIOLOGICAL STUDIES IN SUPPORT OF MANNED SPACE FLIGHT Final Report, Dec. 1977
Dec. 1977 108 p refs
(Contract NAS9-14920)
(NASA-CR-151626) Avail: NTIS HC A06/MF A01 CSCL 06P

Breath-by-breath measurements of pulmonary capillary O2 transfer and ventilation with a box-balloon spirometer and mass spectrometer were made on 3 subjects before, during and after 10 min of lower body negative pressure (LBNP) at -20, -40 and -60 Torr with arterial samples at -60 Torr. Deficits in blood O2 stores (O2B) were noted during LBNP with repayment of O2B during recovery being related to the intensity of LBNP stress. Concurrent calf volume, measured with a Hg strain gauge, decreased towards baseline well before the peak rise in pulmonary capillary O2 transfer after the release of LBNP which signified that O2B changes were related to blood volume shifts. The return of O2-depleted pooled blood to the central circulation during the first min. of recovery caused significant stress-related hyperpnea which peaked near 30 sec. and returned to near baseline after the first min. Three-compartment lung model analyses indicated an increase in the ventilated unperfused lung fraction from 0.09 to 0.17 with the effective compartment decreasing from 0.83 to 0.77. It appears that the 30% increase in ventilation equivalent was primarily the result of less effective lung perfusion during the LBNP. Author

N78-17665# Naval Aerospace Medical Research Lab., Pensacola, Fla.
THE EFFECT OF CAFFEINE ON HUMAN DARK ADAPTATION Interim Report
Tommy R. Morrison and Gerald M. Long 6 Apr. 1977 34 p refs
(AD-A043298; NAMRL-1235) Avail: NTIS HC A03/MF A01 CSCL 06/15

The consumption of caffeine by naval personnel in the operational environment is extensive and frequent. In particular, pilots, aircrewmen, watchstanders, and drivers often consume coffee prior to their performance of missions or tasks at night. The present two experiments were designed to investigate the effects of caffeine upon the absolute detection thresholds during dark adaptation. Within certain subjects caffeine consumption resulted in lower detection thresholds. The caffeine enhancement effect was significant only during the portion of dark adaptation following the rod-cone break. No evidence was found for a detrimental effect of caffeine on dark adaptation.
Author (GRA)

N78-17666# Human Engineering Labs., Aberdeen Proving Ground, Md.
PHYSIOLOGICAL CORRELATES OF PERFORMANCE IN A LONG DURATION REPETITIVE VISUAL TASK Final Report
Nicholas John Carriero Jun. 1977 28 p Repr. from the book "Vigilance: Theory, Operational performance and Physiological Correlates" New York, Plenum Press, 1977
(AD-A043047; HEL-TM-21-77) Avail: NTIS HC A03/MF A01 CSCL 01/10

This study examined the effectiveness of heart activity (HR), respiration (RESP), muscle activity (EMG), skin conductance (SCL), and brain wave activity (EEG) as discriminators of correct vs. incorrect performance in a repetitive visual task of approximately 2 hours' duration. Separate analyses were made of the data to distinguish the operation of task difficulty from performance accuracy. In addition, both of the analyses were repeated using standard score transforms of the raw data to compensate for individual differences. An interactive statistical design was employed to assess the differential changes of the physiological variables with accuracy over time. This design proved to be of crucial importance in assessing this relationship since the accuracy main effect of RESP, EMG, and HR was insignificant in all four data treatments. The accuracy-by-time interactions were significant in a number of instances and established the efficacy of these parameters as discriminators of performance adequacy. Additionally, the standard score transforms proved essential to establishing these relationships when the variance in task difficulty was eliminated. The implication of these findings for the development of an alertness indicator is also discussed.
Author (GRA)

N78-17667# Dynatech R/D Co., Cambridge, Mass.
DEVELOPMENT OF A SYNTHETIC POLYMER BURN COVERING Progress Report, 1 Jan. - 30 Jun. 1977
J. B. Gregory, J. D. Gresser, and D. L. Wise 18 Jul. 1977 38 p ref
(Contract N00014-73-C-0201)
(AD-A042459; Dynatech-1631) Avail: NTIS HC A03/MF A01 CSCL 06/12

During the period January 1, 1977, to June 30, 1977, a new plasticized version of the poly-epsilon-caprolactone (PCL) wipe-on solution designed for use as an immediate post-burn treatment has been evaluated at NMRI on pigs under the supervision of Captain Burgoon D.V.M. Initial results show a significant improvement in the rate of burn healing and reduction of scar formation. The up-take of labelled proline has been demonstrated to correlate with formation of new collagen in burned areas using rats. Using C(14) labelled PCL, it has been demonstrated that PCL is not absorbed by the tissues from the wipe-on coating. GRA

N78-17668# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
A COMPARISON OF EXERCISE RESPONSES OF MALES AND FEMALES DURING ACUTE EXPOSURE TO HYPOBARIA Ph.D. Thesis
Philip R. Elliott Dec. 1976 155 p refs
(AD-A045383; AFIT-CI-77-1) Avail: NTIS HC A08/MF A01 CSCL 06/19

This study was designed to investigate the effects of acute altitude exposure on selected pulmonary, cardiovascular, and metabolic variables in men and women during submax and max work. All testing was conducted in a hypobaric chamber with each subject being tested initially at the terrestrial altitude of 1576 m to which they were acclimated. Subsequent tests were conducted at simulated altitudes of 2743 m and 3962 m. During the recovery period, heart rate was recorded during submax and max exercise as well as recovery. Minute ventilation, breathing frequency, and oxygen pulse were calculated for submax and max exercise. Mean arterial blood pressure was recorded for submax exercise only. Oxygen consumption, respiratory exchange ratio, and ventilation equivalent for oxygen were calculated for max exercise only. Females tolerated hypoxia better during submax work than did men. During maximal work, the men apparently had a better tolerance for hypoxia than did the women. GRA

N78-17669# Naval Ocean Systems Center, San Diego, Calif.
RESOLUTION REQUIREMENTS FOR SLOW-SCAN TELEVISION TRANSMISSION OF X-RAYS. A TEST REPORT FOR THE REMOTE MEDICAL DIAGNOSIS SYSTEM Research and Development Report, Nov. 1976 - Jan. 1977

W. T. Rasmussen, R. L. Crepeau, and F. H. Gerber 19 Sep. 1977 76 p
(AD-A047870; NOSC/TR-150) Avail: NTIS HC A05/MF A01 CSCL 17/2

The Remote Medical Diagnosis System (RMDS) is being developed to link ships and shore stations lacking professional medical staffs with larger ships and stations having such staffs. Although RMDS will be capable of transmitting a variety of visual and auditory medical data (e.g., X-rays, ECGs, voice and heart-lung sounds, etc), its most important use will be for the transmission of high-quality X-ray images. Because of system limitations and other design factors, the resolution of the system must be limited to no more than that necessary for functionally satisfactory performance. As used here, functionally satisfactory performance specifically means that the performance of the radiologist in interpreting X-rays and related data transmitted by RMDS must be substantially as effective as his performance in interpreting original X-ray images. In order to determine the resolution which will actually be required in use of the system, a series of tests was planned and conducted. In these tests, radiologists at the San Diego Naval Regional Medical Center interpreted test X-rays which were displayed at various levels of resolution. The responses of the radiologists were analyzed to derive the minimum resolution levels which would be compatible with system design and operational requirements. The body of the report describes the experiment, the results obtained, and the conclusions drawn from the results including specific guidelines for resolution needed in the RMDS visual channel. Author (GRA)

N78-17670# Medical Care Development, Inc., Augusta, Maine.
ELECTROENCEPHALOGRAPHIC AND GALVANIC SKIN RESPONSES TO VERBAL STIMULI Progress Report, Sep. - Jun. 1970
Robert A. Cowan Nov. 1977 93 p refs
(PB-274175/9; MCD/ITS-77/02) Avail: NTIS HC A05/MF A01 CSCL 05J

The electroencephalographic (EEG) and galvanic skin response (GSR) responses of a subject when presented evocative and nonevocative verbal stimuli were investigated. GSR was analyzed according to resistance variation and EEG was analyzed using spectral density curves, autocorrelation functions, cross energy spectrums and cross correlation plots. GSR was found to significantly reflect the subject's appraisal of evocative stimuli. EEG was found to demonstrate a significant increase in energy for frequencies between 15 and 20 Hz and a higher average frequency when the subject was in the evocative stimuli condition. GRA

N78-17100*# California Univ., Berkeley. Lawrence Radiation Lab.
LIGHT FLASH OBSERVATIONS: EXPERIMENT MA-106
T. F. Budinger, C. A. Tobias, R. H. Huesman, F. T. Upham, T. F. Wieskamp (Calif. Univ., Livermore Lawrence Livermore Lab.), J. U. Schott (Frankfurt Univ.), and E. Schopper (Frankfurt Univ.) *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 193-209 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 06P

N78-17104*# Baylor Univ., Waco, Tex. College of Medicine.
CELLULAR IMMUNE RESPONSE: EXPERIMENT MA-031
B. Sue Criswell and Kathy Cobb *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 257-262 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 06P

N78-17105*# Baylor Univ., Waco, Tex. College of Medicine.
POLYMORPHONUCLEAR LEUKOCYTE RESPONSE: EXPERIMENT MA-032
R. Russell Martin, Glenn A. Warr, Margaret J. Putman, Diane H. Kentor, and Carolinda L. Holleman *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 263-279 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 06P

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N78-17671# Civil Aeromedical Inst., Oklahoma City, Okla.
JOB ATTITUDES OF AIRWAY FACILITIES PERSONNEL
Rodger C. Smith and Gary L. Hutto Aug. 1977 87 p refs
(AD-A046412; FAA-AM-77-21) Avail: NTIS HC A05/MF A01 CSCL 05/10

A total of 2,366 employees of the Airway Facilities (AF) Service responded to a detailed questionnaire concerning job satisfaction and such factors as salary, shift schedule, workload, and geographic location. In general, AF employees reported satisfaction with employment by the AF Service, particularly in the areas judged most important by them: salary, job security, independence and personal responsibility, and achievement. Dissatisfaction was focused on various aspects of working conditions, such as shift rotation, management effectiveness, promotion opportunities, and paperwork. Detailed analyses of responses as a function of such variables as age, grade level, location, and AF program are presented. The findings are discussed in terms of the implications for improving the job-related attitudes of AF personnel. Author

N78-17672# Calspan Corp., Buffalo, N. Y.
AN ASSESSMENT OF THE ROLE OF SIMULATORS IN MILITARY TACTICAL FLIGHT TRAINING. VOLUME 2: ASSESSMENT BASED ON LITERATURE SURVEY Final Report, 15 Apr. - 30 Sep. 1976
C. R. Chalk and R. Wasserman 30 Sep. 1976 89 p refs
(Contract MDA903-76-C-0274)
(AD-A040607; CALSPAN-AK-5790-F-1-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 05/9

The objective of this study was to assess the use of simulators in military tactical flight training. The assessment was made on the basis of information obtained from a literature survey and a survey of individuals in industry and government agencies who are knowledgeable about flight simulators, military tactical flight training and related matters. Forty six organizations were visited during the survey. Assessments are made of the use of simulators for training the following flight phases or tasks: cockpit procedures, instrument flight, emergency procedures, takeoff and landing, formation flight, aerial refueling, dynamic failures, ground attack, training of maneuver limits, recovery from uncontrolled flight, air combat and nonpilot crew stations. Other aspects of the use of simulators for aircrew training are discussed and problem areas requiring research and development effort are identified. GRA

N78-17673# Air Force Human Resources Lab., Brooks AFB, Tex.
BUFFET SIMULATION FOR ADVANCED SIMULATOR FOR PILOT TRAINING ASPT Final Report
Michael L. Cyrus and Terrance K. Templeton Mar. 1977 13 p
(AD-A040550; AFHRL-TR-77-4) Avail: NTIS HC A02/MF A01 CSCL 05/9

This paper presents a motion/control landing buffet simulation package as implemented on the Advanced Simulator for Pilot Training (ASPT) located at Williams AFB, Arizona. All primary buffet effects are included. The high level of pilot acceptance and subjective realism indicate a simplified approach to buffet simulation is sufficient for training purposes. Author (GRA)

N78-17674# Texas Christian Univ., Fort Worth. Inst. of Behavioral Research.
MODERATOR ANALYSIS BASED ON SUBGROUPING: PROBLEMS ARISING FROM THE USE OF STANDARDIZED VARIABLES
L. R. James, K. E. Coray, and R. G. Demaree 4 Nov. 1977 28 p
(Contracts N00014-77-C-0123; PHS-DS-01931-01)
(AD-A047892; IBR-77-21) Avail: NTIS HC A03/MF A01 CSCL 05/10

The use of parameters based on standardized variables, such as correlation coefficients or beta-weights, in subgrouping

moderator analysis is addressed. It is suggested that a comparison of correlation coefficients or beta-weights across different populations may lead to results that are erroneous with respect to true causal processes. Moreover, it is proposed that even in descriptive analyses, parameters based on standardized data may vary across populations simply because of population specific idiosyncracies. It is recommended that subgrouping moderator analysis be based on unstandardized data and that more attention be given to causal considerations. Author (GRA)

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N78-17675* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
WALKING BOOT ASSEMBLY Patent
Hubert C. Vykukal, Alan B. Chambers, and Roy H. StJohn, inventors (to NASA) Issued 27 Dec. 1977 7 p Filed 23 Dec. 1976 Supersedes N77-14742 (15 - 05, p 0661)
(NASA-Case-ARC-11101-1; US-Patent-4,064,642; US-Patent-Appl-SN-753976; US-Patent-Class-36-92; US-Patent-Class-36-119; US-Patent-Class-2-2.1A) Avail: US Patent Office CSCL 05H

A walking boot assembly particularly suited for use with a positively pressurized spacesuit is presented. A bootie adapted to be secured to the foot of a wearer, an hermetically sealed boot for receiving the bootie having a walking sole, an inner sole, and an upper portion adapted to be attached to an ankle joint of a spacesuit, are also described.
Official Gazette of the U.S. Patent Office

N78-17676* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
WRIST JOINT ASSEMBLY Patent
Leendert Kersten (Nebraska Univ., Lincoln) and James Dwight Johnson, inventors (to NASA) Issued 17 Jan. 1978 10 p Filed 26 Jul. 1976 Supersedes N76-28554 (14 - 19, p 2465)
(NASA-Case-MFS-23311-1; US-Patent-4,068,763; US-Patent-Appl-SN-708800; US-Patent-Class-214-1CM; US-Patent-Class-3-12.5; US-Patent-Class-74-515E) Avail: US Patent Office CSCL 05H

A wrist joint assembly is provided for use with a mechanical manipulator arm for finely positioning an end-effector carried by the wrist joint on the terminal end of the manipulator arm. The wrist joint assembly is pivotable about a first axis to produce a yaw motion, a second axis is to produce a pitch motion, and a third axis to produce a roll motion. The wrist joint assembly includes a disk segment affixed to the terminal end of the manipulator arm and a first housing member, a second housing member, and a third housing member. The third housing member and the mechanical end-effector are moved in the yaw, pitch, and roll motion. Drive means are provided for rotating each of the housings about their respective axis which includes a cluster of miniature motors having spur gears carried on the output drive shaft which mesh with a center drive gear affixed on the housing to be rotated.
Official Gazette of the U.S. Patent Office

N78-17677* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
RESTRAINING MECHANISM Patent
John C. Hardy, inventor (to NASA) (United Aircraft Corp., East Hartford, Conn.) Issued 20 Jan. 1970 3 p Filed 6 Oct. 1966 Sponsored by NASA
(NASA-Case-MSC-13054; US-Patent-3,490,074; US-Patent-Appl-SN-585217; US-Patent-Class-2-161) Avail: US Patent Office CSCL 05H

A restraining mechanism restraining a pressurized garment so as to limit its ballooning effect is described. A helically wound spring is bonded at its outer periphery to an elongated flat plate which permits the flat plate to bend in a single direction. The flat plate is attached to an inflatable glove to the palm side for restraining the glove from ballooning when inflated. B.B.

N78-17678* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
HELMET LATCHING AND ATTACHING RING Patent
Edward W. Chase (United Aircraft Corp., East Hartford, Conn.) and Seppo J. Viikinsalo, inventors (to NASA) (United Aircraft Corp., East Hartford, Conn.) Issued 13 Jan. 1970 5 p Filed 17 Mar. 1966 Sponsored by NASA
(NASA-Case-XMS-04670; US-Patent-3,488,771; US-Patent-Appl-SN-535169; US-Patent-Class-2-2.1) Avail: US Patent Office CSCL 05H

A neck ring releasably secured to a pressurized garment carries an open-ended ring normally in the engagement position fitted into an annular groove and adapted to fit into a complementary annular groove formed in a helmet. Camming means formed on the inner surface at the end of the helmet engages the open-ended ring to retract the same and allow for one motion donning even when the garment is pressurized. A projection on the end of the split ring is engageable to physically retract the split ring. Official Gazette of the U.S. Patent Office

N78-17679* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PROTECTIVE GARMENT VENTILATION SYSTEM Patent
Ronald Lang, inventor (to NASA) (United Aircraft Corp., East Hartford, Conn.) Issued 6 Jan. 1970 8 p Filed 6 Oct. 1966 Sponsored by NASA
(NASA-Case-XMS-04928; US-Patent-3,487,765; US-Patent-Appl-SN-584914; US-Patent-Class-98-1) Avail: US Patent Office CSCL 05H

A method and apparatus for ventilating a protective garment, space suit system, and/or pressure suits to maintain a comfortable and nontoxic atmosphere within is described. The direction of flow of a ventilating and purging gas in portions of the garment may be reversed in order to compensate for changes in environment and activity of the wearer. The entire flow of the ventilating gas can also be directed first to the helmet associated with the garment. B.B.

N78-17680* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
HELMET FEEDPORT Patent
Ewald Kothe, inventor (to NASA) (United Aircraft Corp. East Hartford, Conn.) Issued 26 Dec. 1967 3 p Filed 30 Mar. 1966 Sponsored by NASA
(NASA-Case-XMS-09653; US-Patent-3,359,568; US-Patent-Appl-SN-538863; US-Patent-Class-2-6) Avail: US Patent Office CSCL 05H

A helmet design is described which encapsules the head of the wearer, is capable of being pressurized and provides a means for gaining internal access for the purpose of eating. A mechanically actuated valve that combines the purging of carbon dioxide and feeding operations by a simple movement of a mechanical lever obviates problems that are attendant in the type of feed and purge ports previously incorporated in pressurized helmets.
B.L.P.

N78-17681*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Biotechnology
DEVELOPMENT OF A PREPROTOTYPE TRACE CONTAMINANT CONTROL SYSTEM
31 Mar. 1977 88 p refs
(Contract NAS9-14897)
(NASA-CR-151632) Avail: NTIS HC A05/MF A01 CSCL 06K

The steady state contaminant load model based on shuttle equipment and material test programs, and on the current space station studies was revised. An emergency upset contaminant load model based on anticipated emergency upsets that could occur in an operational space station was defined. Control methods for the contaminants generated by the emergency upsets were established by test. Preliminary designs of both steady state and emergency contaminant control systems for the space station application are presented. Author

N78-17682# Human Engineering Labs., Aberdeen Proving Ground, Md.
EXAMINATION OF AUDITORY ATTENTION AND VISUAL EVOKED POTENTIALS Final Report
Lynn C. Oatman and Jeffrey H. Lukas Jun. 1977 19 p refs (AD-A042619; HEL-TM-22-77) Avail: NTIS HC A02/MF A01 CSCL 05/10

The present research is a continuation into the investigation of the physiological mechanisms responsible for the selective process that controls sensory input to the central nervous system. This experiment was conducted to examine whether visual evoked potentials recorded from the lateral geniculate and visual cortex are suppressed in amplitude during attention to auditory stimulation. The results show that increased auditory attention had no significant arousal effects or changes in the amplitudes of the evoked responses recorded along the visual pathway.
GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N78-17683 Case Western Reserve Univ., Cleveland, Ohio.
A MULTI-CRITERIA DECISION MODEL WITHIN A METHODOLOGY FOR COMPUTER SYSTEM SELECTION Ph.D. Thesis
Csaba Jose Egyhazy 1976 224 p
Avail: Univ. Microfilms Order No. 77-11944

A methodology, for computer system selection composed of three phases was developed. The preselection phase intent analyzed the different possibilities available to the institution besides the acquisition of a new computer system and evaluated the performance of the various candidate computer systems. The techno-economic model focused on the technical requirements the computer system ought to have, the financial consequences of each candidate system, and the value of the intangible criteria that influenced the decision selection process. A decision model for computer system selection was formulated, computerized, and its main logic represented by a series of flow charts.
Dissert. Abstr.

N78-17684 California Univ., Santa Barbara.
THE CONFIGURATION OF AN INFORMATION PROCESSING UTILITY Ph.D. Thesis
Jay Stewart Bayne 1977 188 p
Avail: Univ. Microfilms Order No. 77-25593

Contained herein is a study of optimizing computer system performance based on analytic representations of system behavior. An Information Processing Utility (IPU) is defined and its structural features are expressed in terms of a hardware descriptor system. This system provides a means of relating component cost and performance as well as introducing system configuration rules. Combined with queuing theoretic models of overall system performance, an analysis of optimal configuration policies is presented.
Dissert. Abstr.

N78-17685 Minnesota Univ., Minneapolis.
A COMPUTER ARCHITECTURE BASED ON ORDERED SETS AS PRIMITIVE DATA ENTITIES Ph.D. Thesis
Helmut Karl Berg 1977 367 p
Avail: Univ. Microfilms Order No. 77-26079

The synthesis of a concept of computer architectures - the concept of data structure architectures - for general-purpose computing is described. A representative implementation of the concept is proposed. Details of the internal information structure are discussed on the basis of a representative set of machine operators that allows for the generation, processing, and restructuring of arbitrary data structures which are represented in terms of basic elements. The detailed design of the processors and of the intrasystem communication structure as well as a study of an operating system demonstrate that the concept incorporates essential operating system operators into the hardware.
Dissert. Abstr.

N78-17686 Illinois Univ., Urbana-Champaign.
AN ARITHMETIC UNIT FOR ON-LINE COMPUTATION Ph.D. Thesis
Mary Jane Irwin 1977 156 p
Avail: Univ. Microfilms Order No. 77-26683

The algorithmic and logic design of an arithmetic unit to be used in a computational environment in which basic arithmetic operations satisfy the on-line property is presented. There was no on-line delay for addition subtraction and multiplication so the unit began generating result digits as soon as one digit of each operand was input. The delay for division was shown to be a small, positive, radix dependent constant. Algorithms and a block diagram level implementation of the basic arithmetic unit are discussed. The proposed arithmetic unit performed on-line operations and would be extremely useful in many real time applications. Due to its potential for performing sequences of pipeline operations, the unit provided an effective way to speed up execution.
Dissert. Abstr.

N78-17687 Massachusetts Univ., Amherst.
COMPILING TECHNIQUES FOR ASSOCIATIVE PROCESSORS Ph.D. Thesis
Frederic Jean-Francois Richard 1977 289 p
Avail: Univ. Microfilms Order No. 77-26434

The implementation on associative processors of translators from high level programming languages to machine language is shown. Existing formalisms for syntax analysis and code generation were examined, and efficient techniques for parallel compilation on a model associative processor were derived. Techniques for parallel translation are presented, and the advantages and limitations of parallel compilation and associative processors are discussed.
Dissert. Abstr.

N78-17688 Utah Univ., Salt Lake City.
SHAPE OPERATORS FOR COMPUTER AIDED GEOMETRIC DESIGN Ph.D. Thesis
Jeffrey Michael Lane 1977 108 p
Avail: Univ. Microfilms Order No. 77-27707

The mathematical theory of Total Positivity is combined with the interactive techniques of Bezier and Riesenfeld in developing new methods of shape representation which retain the valuable variation-diminishing and convex hull properties of Bernstein and B-spline approximation, while providing improvements in the interactive interface to the user. Specifically, extending the Bezier notion of using a polygon to describe a smooth curve, methods of assigning a weight to each vertex which will control the amount of local fit to the polygon or polygonal net are provided. Thus, the designer can cause cusps and flats easily by manipulating the tension at each vertex. Further, the generalization from curves to surfaces can be done with rectilinear data or triangular data. The feasibility and utility of the newly constructed models for interactive design are demonstrated on an experimental system for curve and surface design.
Dissert. Abstr.

N78-17689 George Washington Univ., Washington, D. C.
AN INVESTIGATION OF THE EXTENT TO WHICH COMPUTER HARDWARE AND SOFTWARE RE-EVALUATION IS PERFORMED IN SELECTED FEDERAL GOVERNMENT AGENCIES IN ORDER TO IMPROVE OVERALL SYSTEM EFFECTIVENESS Ph.D. Thesis
Robert Larry Johnson 1977 245 p
Avail: Univ. Microfilms Order No. 77-29517

A lack of formal documentation, standardization, and detail in hardware and software re-evaluation planning exists in most federal agencies. Although either hardware or software re-evaluation tools did exist in all of the agencies interviewed, these tools were employed only at a very basic level. Few of the agencies ever re-evaluated their application programs after implementing the programs. Most agencies acknowledged the importance of hardware and software re-evaluation to achieve maximum use of their computer systems few felt that re-evaluation was currently an important part of management policy. Dissert. Abstr.

N78-17690 Purdue Univ., Lafayette, Ind.
THREE DIMENSIONAL DESIGN BY GRAPHICAL MAN-COMPUTER COMMUNICATION Ph.D. Thesis
John Arthur Brewer, III 1977 126 p
Avail: Univ. Microfilms Order No. 77-30059

A designer can generate and graphically interact with three dimensional forms using two dimensional input devices and displays by the man-computer communication techniques. The mathematical modeling algorithms intended for free form design were investigated. Intuitive visual control of shape using curve and surface algorithms of the Coons type was accomplished. An experimental graphics system capable of handling multiple objects composed of points, lines, curves, and surfaces was described. A three dimensional cursor and a planar shaping tool were used to sketch and manipulate objects in a visually controlled, interactive environment. An associative transformation structure combines with high level data generation directives to allow the creation of node meshes and surface mats for preliminary shape and design. Dissert. Abstr.

N78-17691* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BINARY TO BINARY CODED DECIMAL CONVERTER Patent
Anthony J. Miller, inventor (to NASA) Issued 17 Jan. 1978 7 p Filed 12 Nov. 1975 Supersedes N76-13781 (14 - 4, p 0495)
(NASA-Case-GSC-12044-1; US-Patent-4,069,478; US-Patent-Appl-SN-631341; US-Patent-Class-340-347DD) Avail: US Patent Office CSCL 09B

A binary coded input signal is converted to a binary coded decimal signal having N decades by employing N four bit shift registers. The bits of the input signal are sequentially supplied, in order, to the least significant position of the register for the units decade, with the most significant bit of the input signal being applied to the units register first. Each of the registers includes a right shift-parallel load mode control input terminal. In response to the sum of the values stored in each register and the binary value 0011 being less than the binary value 1000, the mode control input terminal is activated to shift the register contents one bit to the right. In response to the sum being greater than 1000, the mode control input terminal is activated to load the sum into the register.
Official Gazette of the U.S. Patent Office

N78-17692# Mitre Corp., McLean, Va. Metrek Div.
DISTRIBUTED PROCESSING APPLIED TO THE FLIGHT SERVICE STATION MODERNIZATION PROGRAM
T. B. Fowler Aug. 1977 205 p
(Contract DOT-FA69NS-162)
(AD-A047930; MITRE-7576; FAA-RD-77-161) Avail: NTIS HC A10/MF A01 CSCL 09/2

An investigation was done on the feasibility of using minicomputers in a distributed processing configuration for the Flight Service Station modernization program. It was based on studies of existing distributed processing configurations, many of which were visited by members of the MITRE/FAA distributed processing study team; on information supplied by vendors; and on an analysis of two sample configurations taking into account available data concerning Flight Service Station (FSS) functions. Distributed Processing, as applied to the FSS modernization program, was analyzed with respect to cost, degree of risk, and expected level of performance. Recommendations are given based upon analysis, research, and visits to existing distributed processing installations. Author

N78-17693# Chemical Abstracts Service, Columbus, Ohio.
INTRODUCTION TO FACILITY FOR INTEGRATED DATA ORGANIZATION (FIDO)
Feb. 1977 20 p refs
(Contract NSF C-656)
(PB-273726/0; CAS-245) Avail: NTIS HC A02/MF A01 CSCL 09B

Because of file size and variability, Chemical Abstracts Service developed a data management system which permits operation with greater generality, flexibility, and security than that allowed by conventional processing methods. The design, implementation, and operation of the system is described. GRA

N78-17694# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
DISTRIBUTED DATA PROCESSING TECHNOLOGY. VOLUME 2: DDP RATIONALE. THE PROGRAM PLANNING POINT OF VIEW Final Report, Oct. 1976 - Oct. 1977
W. E. Boebert Sep. 1977 125 p refs
(Contract DAS 60-76-C-0087)
(AD-A047473; HONEYWELL-77SRC66-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 09/2

The possibility of quantifying the payoffs (i.e., nonfunctional requirements) associated with the application of distributed data processing (DDP) is investigated. The problem of quantification is discussed and a set of non-quantified payoffs is presented. Two approaches to quantified payoffs are also developed.
Author (GRA)

N78-17695# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
DISTRIBUTED DATA PROCESSING TECHNOLOGY. VOLUME 3: DDP RATIONALE. THE TECHNOLOGY POINT OF VIEW Final Report, Oct. 1976 - Oct. 1977
R. Ramseyer Sep. 1977 56 p refs
(Contract DASG60-76-C-0087)
(AD-A047474; HONEYWELL-77SRC67-Vol-3) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report examines some of the salient points in the evaluation of data processing systems. An overview of the classification scheme for architectures is followed by somewhat detailed examinations of classic examples of each architecture. The advantages and future of distributed processing systems are pointed out throughout the report. Author (GRA)

N78-17696# General Research Corp., Santa Barbara, Calif.
DISTRIBUTED DATA PROCESSING TECHNOLOGY. VOLUME 6: APPLICATION OF DDP TECHNOLOGY TO BMD. IMPACT ON CURRENT DP SUBSYSTEM DESIGN AND DEVELOPMENT TECHNOLOGIES Final Report, Oct. 1976 - Oct. 1977
J. Benson, D. Palmer, and R. Stone Sep. 1977 74 p refs Prepared for Honeywell, Inc., Minneapolis, Minn.
(Contract DASG60-76-C-0087)
(AD-A047477; HONEYWELL-77SRC70-Vol-6) Avail: NTIS HC A04/MF A01 CSCL 09/2

The report concentrates on one research task--assessment of the mutual impact of DDP design requirements on existing data processing design and development technologies. This research was directed into three primary areas: software engineering, performance validation, and system, environment, and threat simulation (SETS). Author (GRA)

N78-17697# General Research Corp., Santa Barbara, Calif.
DISTRIBUTED DATA PROCESSING TECHNOLOGY. VOLUME 8: APPLICATION OF DDP TECHNOLOGY TO BMD. RESEARCH PERFORMANCE MEASUREMENT Final Report, Oct. 1976 - Oct. 1977
R. Pennington, K. Watson, G. Convoy, and B. Stewart Sep. 1977 83 p refs Prepared for Honeywell, Inc., Minneapolis, Minn.

(Contract DASG60-76-C-0087)
(AD-A047479; HONEYWELL-77SRC72-Vol-8) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report is concerned with measurement and evaluation of Distributed Data Processing (DDP) research and the products of that research. A measure of completeness and conformity to the statement of work is included. Two design technology evaluation models are presented. An evaluation of the literature on research measurement is discussed, and a particular set of criteria and a research measurement approach are suggested.
Author (GRA)

N78-17698# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
DISTRIBUTED DATA PROCESSING TECHNOLOGY. VOLUME 9: DDP RATIONALE. THE PROGRAM EXPERIENCE POINT OF VIEW Final Report, Oct. 1976 - Oct. 1977
C. Huang and L. Bean Sep. 1977 92 p refs
(Contract DASG60-76-C-0087)
(AD-A047480; HONEYWELL-77SRC73-Vol-9) Avail: NTIS HC A05/MF A01 CSCL 09/2

This volume discusses DDP rationale from the program experience point of view. The payoffs of DDP concept achieved in contract studies are described. The payoffs and research issues of DDP from the perspective of the real-world Site Defense Experience are also discussed. Author (GRA)

N78-17699# Science Applications, Inc., Arlington, Va.
EXPLORATORY EXAMINATION OF PURGE TECHNIQUES Final Report, 15 Sep. 1976 - 15 Jul. 1977
John J. Saalberg, James R. Miller, Terry L. Friesz, and Carol A. Kegan Nov. 1977 155 p refs
(Contract DAHC19-76-C-0050)
(AD-A047354; SAI-78-614-WA; ARI-TR-77-A21) Avail: NTIS HC A08/MF A01 CSCL 15/7

The problem of overload in tactical information systems can be reduced by purging--freeing a tactical data base of useless, redundant, outdated, and incorrect information Technological changes in ground combat and in information acquisition and handling have created the requirement for an automated Tactical Operations System (TOS) for command and control, and established a need for purging. This report analyzes the role of information in decisionmaking and examines techniques for identifying a decisionmaker's information needs. Current purging procedures and division level informational needs for land combat are reviewed and potential criteria developed for identifying information essential for task performance in the Division Tactical Operations Center. Rules, techniques and operative procedures are suggested which can be employed to manage and control TOS data. Purging procedures employed with manual files or written records are not directly adaptable to automated systems, although such procedures provide precedents which can aid in establishing suitable methods for purging automated systems. The computer industry has not focused upon purging as a problem. However, a number of available computer science techniques can help meet purging needs. A number of existing quantitative methods can be used to evaluate purge technology innovations. New innovative methods are required for managing combat information in automated systems at Army Division level to prevent overload and to improve control and direction of engaged forces. Author (GRA)

N78-17700# Maryland Univ., College Park. Computer Science Center.
DESIGN OF AN ADAPTIVE, PARALLEL FINITE ELEMENT SYSTEM
Pamela Zave and Werner C. Rheinbolt Nov. 1977 44 p refs
(Contract N00014-77-C-0623)
(AD-A047353; TR-593) Avail: NTIS HC A03/MF A01 CSCL 09/2

A design for a novel prototype finite element system is presented which meets the following four goals: the system constitutes an application-independent finite element solver for a certain class of linear elliptic problems based on a weak mathematical formulation; it incorporates extensive adaptive approaches to minimize the critical decisions demanded of the user; it incorporates adaptive error estimation techniques to provide an optimal solution within a prescribed cost range; and it takes advantage of natural parallelism and modularity to increase the size of the practically solvable problems. The overall system structure is described in terms of parallel processes and is implementable on a wide variety of hardware configurations. The experiments planned to evaluate the various new approaches are also presented. Author (GRA)

N78-17701# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
DISTRIBUTED DATA PROCESSING TECHNOLOGY. VOLUME 4: APPLICATION OF DDP TECHNOLOGY TO BMD ARCHITECTURES AND ALGORITHMS Final Report, Oct. 1976 - Oct. 1977
M. G. Gouda, Y. W. Han, E. D. Jensen, W. D. Johnson, and R. Y. Kain Sep. 1977 191 p refs
(Contract DASG60-76-C-0087)
(AD-A047475; HONEYWELL-77SRC68-Vol-4) Avail: NTIS HC A09/MF A01 CSCL 09/2

This volume presents the results of research on techniques to develop distributed data processing architectures for specific functions, with particular reference to BMD functions. It describes two methodologies and six designs for two BMD functions. Short discussions of two nonfunctional payoffs are included to aid future workers on these problems. Many suggestions for future research and development activities are given. Author (GRA)

N78-17702# Maryland Univ., College Park. Dept. of Information Systems Management.
PROBLEMS IN THE TRANSLATION AND STANDARDIZATION OF RELATIONAL AND NETWORK TYPE DATA BASE MANAGEMENT SYSTEMS Final Report, 30 Jun. 1976 - 29 Jun. 1977
Edgar H. Sibley 14 Sep. 1977 4 p
(Grant DAAG29-76-G-0300)
(AD-A047733; ARO-14322.1-A-EL) Avail: NTIS HC A02/MF A01 CSCL 05/2

Database Management Systems (DBMS) are now well established as a tool for information system implementation. However, the debates over relational and network systems have underlined the need to provide new systems with both capabilities as well as to understand the theoretical aspects which will make standardization possible. The reported research is intended to foster such an approach. GRA

N78-17703# Maryland Univ., College Park. Dept. of Information Systems Management.
THE DEVELOPMENT OF A PERFORMANCE EVALUATION MODEL FOR DBMS NETWORK STRUCTURES Final Report, 25 May 1976 - 24 May 1977
Edgar H. Sibley and Allen Reiter (Technion - Israel Inst. of Technol.) 12 Aug. 1977 4 p refs
(Grant DAAG29-76-G-0247)
(AD-A047734; ARO-14250.1-A-EL) Avail: NTIS HC A02/MF A01 CSCL 09/2

The field of database management systems (DBMS) is one of the most rapidly expanding areas in automated information technology today. One of the major problems faced by the users of DBMS is the decision on what types of problems best suit what classes of systems, and what improvements (or minor reprogramming) could really pay off in terms of better performance for small capital outlay. This proposal seeks to model one particular class of DBMS: the network structured system; this model will aid the user in tuning the overall systems for better performance, and help the designer of the information systems in making better logical design decisions. Author (GRA)

N78-17704# Chemical Abstracts Service, Columbus, Ohio.
THIRD UPDATE TO THE FACILITY FOR INTEGRATED DATA ORGANIZATION (FIDO). USER REFERENCE MANUAL
31 Mar. 1977 231 p
(Contract NSF C-656)
(PB-273725/2; CAS-254) Avail: NTIS HC A11/MF A01 CSCL 09B

Facility for Integrated Data Organization (FIDO) is a data management software program which processes Chemical Abstracts Service Standard File Format (SFF) data. This processing

includes the manipulation and validation of SFF segments in core storage and the use of physical sequential and random accessing methods to store and retrieve SFF data. The manual is intended to serve as a planning guide, reference tool, and debugging aid for the programmer or systems analyst using FIDO. GRA

N78-17705# Public Technology, Inc., Washington, D. C. Information Systems Group.
TAPE TRANSFER GUIDE Final Report
1977 20 p
(Contract HUD-H-2341)
(PB-274167/6; HUD/RES-1178) Avail: NTIS
HC A02/MF A01 CSCL 09B

The discussion is one of a series dealing with software documentation to aid in the transfer of local government information systems. This volume provides guidelines for determining the suitability of tape as a transfer medium, for recording data on tape, and for transporting tape from one jurisdiction to another. GRA

N78-17706# Mathematics and Computation Lab., Washington, D. C.
PRINT RE-ENTRANT PROCESSOR Final Report
Kenneth R. Brand, Caroline L. Cashman, and Roland F. Hough Jul. 1977 22 p ref
(PB-274299/7; GSA/FPA/MCL-TM-267) Avail: NTIS
HC A02/MF A01 CSCL 09B

The print processor was developed to provide the capability of routing Univac 1100 series operating system print files to the off-line Honeywell printer. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N78-17707 Rutgers - The State Univ., New Brunswick, N. J.
PROGRAM SCHEMAS WITH SEMANTIC RESTRICTIONS Ph.D. Thesis
Elaine Jessica Weyuker 1977 175 p
Avail: Univ. Microfilms Order No. 77-25030

Paterson introduced the notions of freedom and liberality as semantic restrictions on the class of schemas. He felt that such restricted classes of schemas might have solvable decision problems, and also be realistic models of what would generally be considered 'good' programs. With the latter viewpoint in mind, two new classes of schemas are introduced in this thesis: the reachable schemas and the semifree schemas. Several decision problems for these classes, and translatability between these classes and other semantically restricted schema classes are studied. Relationships between various classes of schemas are also considered. Dissert. Abstr.

N78-17708 Stanford Univ., Calif.
A PRACTICAL FORMAL SEMANTIC DEFINITION AND VERIFICATION SYSTEM FOR TYPED LISP Ph.D. Thesis
Robert Staley Cartwright, Jr. 1977 158 p
Avail: Univ. Microfilms Order No. 77-25755

An attempt is made to accomplish the following objectives: (1) To develop a programming language which is sufficiently powerful to express many interesting algorithms clearly and succintly, yet simple enough to have a tractable formal semantic definition. (2) To completely specify both proof theoretic and model theoretic formal semantics for this language using the simplest possible abstractions. (3) To develop an interactive program verification system for the language which automatically performs as many of the straight-forward steps in a verification as possible. The dissertation describes the motivation for creating TYPED LISP, and defines the semantics of TYPED LISP. The dissertation describes in interactive verification system implementing a natural deduction system. Dissert. Abstr.

N78-17709 Stanford Univ., Calif.
A PARSER FOR ENGLISH AND ITS APPLICATION IN AN AUTOMATIC PROGRAMMING SYSTEM Ph.D. Thesis
Jerrold Martin Ginsparg 1977 164 p
Avail: Univ. Microfilms Order No. 77-25669

The problem of communicating with computers in English is presented. An interface system which allowed a human user to communicate with an automatic programming system in an English dialogue is described. The interface consisted of two parts. The first was a parser called Reader which was designed to facilitate writing English grammars which were nearly deterministic in that they considered a very small number of parse paths during the processing of a sentence. The second part of the interface was an interpreter which represented Reader's output in a form that was used by a computer program without linguistic knowledge. The interpreter must be tailored to each particular application of the interface, since both the data structures it built, and the information needed to build them, were dependent on the needs and domain of the computer program employing the interface. Dissert. Abstr.

N78-17710 Stevens Inst. of Tech., Hoboken, N. J.
FORMAL DEFINITION OF THE SEMANTICS OF PROGRAMMING LANGUAGE STATEMENTS Ph.D. Thesis
Mary Ratchford Hesselgrave 1977 111 p
Avail: Univ. Microfilms Order No. 77-26936

Semantic deduction systems for minilanguages involving generalized assignment, dynamic type checking and static type checking were shown to be consistent and complete with respect to appropriate models. Some of the flexibility of the axiomatic approach to semantics is discussed. A deduction system for the statement level constructs of a small programming language was shown to be complete, using mathematical semantics as a model. Dissert. Abstr.

N78-17711 North Carolina Univ., Chapel Hill.
EXECUTION TIME AND STORAGE REQUIREMENTS OF REDUCTION LANGUAGE PROGRAMS ON A REDUCTION MACHINE Ph.D. Thesis
Alexis KosterVelKotlarz 1977 187 p
Avail: Univ. Microfilms Order No. 77-27271

A methodology was developed to analyze the execution time and the storage requirements of reduction language programs on a new type of computer called a reduction machine; it was applied to matrix multiplication programs and a tree traversing program. Variations in the degree of parallelism of programs allowed the investigation of space/time trade-off. Parallel programs executed very efficiently, but they usually required a large amount of storage. Reduction language operators that minimized data movement were introducted. Dissert. Abstr.

N78-17712 Stanford Univ., Calif.
EMPIRICAL AND ANALYTICAL STUDIES OF PROGRAM REFERENCE BEHAVIOR Ph.D. Thesis
Abbas Rafii 1977 233 p
Avail: Univ. Microfilms Order No. 77-12685

Several aspects of program reference behavior, page reference behavior modeling and evaluation for multiprogramming paging systems were considered. An experimental treatment of the page reference behavior of a number of actual computer programs is given. Statistical and time series analysis were performed on the generated working set sizes and LRU stack distance strings. The effects of page size and other parameters on the distribution, serial correlation, and frequency domain behavior were studied. A number of working set size models are discussed and the ability to capture the observed degree of the serial dependency in the working set size string was examined. A number of algorithms to predict the working set size of a program, based on the past observations, are included. Dissert. Abstr.

N78-17713 Illinois Univ., Urbana-Champaign.
IMPROVING PROGRAMS BY SOURCE-TO-SOURCE TRANSFORMATION Ph.D. Thesis
Paul Edward Rutter 1977 114 p
Avail: Univ. Microfilms Order No. 77-26744

A program manipulation system which sped up LISP programs by rewriting them is described. The system read in programs and input test sets, the program in a controlled fashion, and proposed and carried out changes to the program which may have resulted in faster execution and better algorithms. Improve-

ments fell into two categories: those based solely on the program text, and those which used information learned from running the program. The programmable language-oriented editor which carried out transformation commands, the library of patterns used to organize program transformations, a data and control flow analysis routine, and tools for investigating the dynamic behavior of programs are discussed. Dissert. Abstr.

N78-17714 Stevens Inst. of Tech., Hoboken, N. J.
GENERALIZED HIERARCHIC RETRIEVAL LANGUAGE, GENHRAL Ph.D. Thesis
William Abraham Zeitz 1977 170 p
Avail: Univ. Microfilms Order No. 77-26953

The search algorithm is defined and identified. Two retrieval classes are delineated: the nonrecursive class and the recursive class. The existing commercial or research oriented retrieval languages are shown to be incapable of directly answering queries against CODASYL-like data structures belonging to the Recursive Class of retrieval problems. Three rules which govern the default search process and implied parentage underlying a GENHRAL query are defined. A model is presented and several aspects are discussed. The translation of GENHRAL statements into any high level programming language is examined and the roles governing the SORT verb are presented. Details governing the actual implementation of the GENHRAL default search algorithm are specified. Dissert. Abstr.

N78-17715 Stanford Univ., Calif.
LARGE SCALE BOUNDED VARIABLE QUADRATIC PROGRAMMING Ph.D. Thesis
Mark Stewart Goheen 1977 105 p
Avail: Univ. Microfilms Order No. 77-25670

Two classes of quadratic programs having special, rather simple structure, but potentially very large size are studied. These quadratic programs have strictly convex minimands. Programs discussed have variables which are constrained only by upper and lower bounds and objective functions that have nonpositive mixed partial derivatives and those which are subject to an additional equality constraint. Problems are discussed from the theoretical standpoint. Their solutions are characterized by combining Kuhn-Tucker theory with their special matrix-theoretic properties. A sketch of some applications of these special quadratic programs and a sample of the computational experience acquired with implementations of many of the algorithms are discussed. A study of a decomposition principle for a class of quadratic programming problems having a single coupling equality constraint are discussed in detail. Dissert. Abstr.

N78-17716 Virginia Univ., Charlottesville.
ALGORITHMS ON TREES AND MAXIMAL OUTERPLANAR GRAPHS: DESIGN, COMPLEXITY ANALYSIS, AND DATA STRUCTURES STUDY Ph.D. Thesis
Sandra Lee Mitchell 1977 433 p
Avail: Univ. Microfilms Order No. 77-28582

Computer algorithm development involves three major aspects: (1) design; (2) implementation; and (3) complexity analysis. These phases are described for a variety of graph theoretic algorithms on trees and maximal outerplanar graphs. The problems are restricted to trees and maximal outerplanar graphs in order to find better time bounds on problems which are in the NP complete class. This dissertation shows that NP-complete problems when restricted to trees are almost always linear. The classification of these problems for maximal outerplanar graphs, while only partially complete, appears to be polynomial. Techniques are presented for representing these two classes of graphs. Techniques are established for solving problems on trees and maximal outerplanar graphs. Dissert. Abstr.

N78-17717 Maryland Univ., College Park.
A LANGUAGE-ACCEPTOR TYPE OF PROBABILISTIC CELLULAR AUTOMATION Ph.D. Thesis
Immanuel I-Ming Tung 1977 120 p
Avail: Univ. Microfilms Order No. 77-29139

A language-acceptor type of a probabilistic cellular automaton, called a probabilistic bounded cellular acceptor, was defined and studied. It was shown that the class of all languages accepted by 1-dimensional probabilistic bounded cellular acceptors includes both the class of all languages accepted by bounded cellular acceptors and the class of all languages accepted by probabilistic acceptors. Also, it was shown that every language accepted by a d-dimensional probabilistic bounded cellular acceptor at a given cut point is accepted by a d-dimensional probabilistic bounded cellular acceptor at an arbitrary cut-point (except possibly the cut point 0). In addition, two new types of a probabilistic acceptor, called a serial probabilistic acceptor and a parallel serial probabilistic acceptor, were proposed. Dissert. Abstr.

N78-17718 Cornell Univ., Ithaca, N. Y.
SYNTACTIC ERROR CORRECTION IN PROGRAMMING LANGUAGES Ph.D. Thesis
Kuo-chung Tai 1977 169 p
Avail: Univ. Microfilms Order No. 77-28415

A formal model for error correction using pattern mapping was developed where a pattern describes how to map one string into another. The pattern mapping problem was formalized and its properties were explored. Using a preconstructed list of patterns, for each detected error, one finds the first pattern with successful mapping and makes a correction based on this pattern. Two practical methods for pattern mapping were implemented and compared. Different lists of patterns were used for correction according to different correction criteria. Dissert. Abstr.

N78-17719 Iowa Univ., Iowa City.
PARALLEL GRAPH PROCESSING USING DEPTH-FIRST SEARCH AND BREADTH-FIRST SEARCH Ph.D. Thesis
Denise Marie Eckstein 1977 186 p
Avail: Univ. Microfilms Order No. 77-28449

For a reasonable model of parallel processing, it is shown that k processors performed depth-first search on graphs having n vertices and m edges in time $O(n + (m/k))$. The dependence of m involved m/k, not $(m(\log k))/k$; thus the algorithm was essentially optimal for classes of nonsparse graphs. It is also shown that k processors performed breadth-first search on graphs in time $O(n + (m/k))$. Dissert. Abstr.

N78-17720 Cornell Univ., New York.
POLYNOMIAL REDUCIBILITIES AND COMPLETE SETS Ph.D. Thesis
Leonard Charles Berman 1977 72 p
Avail: Univ. Microfilms Order No. 77-29363

Two of the main tools in the study of resource bounded computing are the polynomial time reduction and the complete set. These notions have unified and simplified complexity by allowing abstract questions to be reduced to a single question about a specific problem. The limitations which are essential in the nature of these tools were investigated. A very restrictive equivalence relation, p-isomorphism was defined and used to study the structure of the NP-complete sets. The known NP-complete sets are all equivalent with respect to this relation. The structure of sets complete for 'high' time classes were studied and it was shown that for these classes many-one and one-one completeness coincide. The question of invertibility was investigated and related to some well known questions in theoretical computer science. Dissert. Abstr.

N78-17721 Cornell Univ., New York.
THE SPECIFICATION OF DATA-DIRECTED INTERACTIVE USER-COMPUTER DIALOGUES Ph.D. Thesis
Juan Mendez Lafuente 1977 231 p
Avail: Univ. Microfilms Order No. 77-28381

A new approach is proposed to the problem of describing the kinds of interactions that take place during user-computer dialogues in the execution of interactive applications. These interactions can be specified very easily, using non-procedural frame descriptions and non-procedural behavior rules. Previous efforts have relied on procedural programming and have required the programmer to think of all possible interaction states occurring during the dialogue. A language is given for programming interactive dialogues. The language is designed as an extension of the programming language PASCAL. The second part of this thesis deals with techniques for the efficient implementation of dialogues in data-directed interactive applications. The concept of an action/response graph is introduced for the internal representation of interactive behavior. Dissert. Abstr.

N78-17722 Iowa Univ., Iowa City.
AN EFFICIENT ALGORITHM FOR STRING PATTERN MATCHING Ph.D. Thesis
Kenchih Liu 1977 195 p
Avail: Univ. Microfilms Order No. 77-28478

Based on the view that pattern matching is a refinement of parsing, Earley's parsing algorithm for context-free patterns was adapted and extended to allow the augmentation of the immediate assignment operation of SNOBOL4 and two set operations, complementation and intersection, by which the expressive power is substantially increased because it allows definition of languages which are not context-free. Canonical pattern definition systems are thus defined to describe patterns for which the algorithm will perform pattern matching. As an empirical evaluation, the algorithm was programmed using PL/1 and run on IBM 360/65 for the justification of practicality. The size of this program is about 16K bytes long and the constant of proportionality for the polynomial time algorithm is not too large. Dissert. Abstr.

N78-17723 Clemson Univ., S.C.
A COMPARISON OF PROGRAMMING THEORIES AND LANGUAGES FOR DISCRETE SIMULATION Ph.D. Thesis
Magdi Aziz Matar 1977 107 p
Avail: Univ. Microfilms Order No. 77-29698

Discrete simulations in FORTRAN for complex systems and for systems in which the modelers have not had previous experience with a similar simulation are studied. A programming theory as a technique that can facilitate the development of discrete simulations in GPSS is presented. The theory is based upon characterizing GPSS by an algebraic structure (rooted automation). Run-time information upon which a choice of using GPSS generics vis-a-vis FORTRAN generics can be made is provided. Finally, a language, DISCSIMU, that can handle a larger class of problems than GPSS is defined. The language has the automatic features of GPSS and the general structure of procedural languages. Author

N78-17724*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTER PROGRAM FOR CALCULATION OF COMPLEX CHEMICAL EQUILIBRIUM COMPOSITIONS, ROCKET PERFORMANCE, INCIDENT AND REFLECTED SHOCKS, AND CHAPMAN-JOUGUET DETONATIONS
Sanford Gordon and Bonnie J. McBride Mar. 1976 145 p refs Revised
(NASA-SP-273) Avail: NTIS HC A07/MF A01 CSCL 09B

A detailed description of the equations and computer program for computations involving chemical equilibria in complex systems is given. A free-energy minimization technique is used. The program permits calculations such as (1) chemical equilibrium for assigned thermodynamic states (T,P), (H,P), (S,P), (T,V), (U,V), or (S,V), (2) theoretical rocket performance for both equilibrium and frozen compositions during expansion, (3) incident and reflected shock properties, and (4) Chapman-Jouguet detonation properties. The program considers condensed species as well as gaseous species. Author

N78-17725*# Kansas Univ., Lawrence. Dept. of Computer Science.
A DATABASE SYSTEM TO SUPPORT IMAGE ALGORITHM EVALUATION Final Report, 15 Nov. 1976 - 31 Dec. 1977
Y. Edmund Lien 31 Dec. 1977 221 p refs
(Grant NsG-8046)
(NASA-CR-155928) Avail: NTIS HC A10/MF A01 CSCL 09B

The design is given of an interactive image database system IMDB, which allows the user to create, retrieve, store, display, and manipulate images through the facility of a high-level, interactive image query (IQ) language. The query language IQ permits the user to define false color functions, pixel value transformations, overlay functions, zoom functions, and windows. The user manipulates the images through generic functions. The user can direct images to display devices for visual and qualitative analysis. Image histograms and pixel value distributions can also be computed to obtain a quantitative analysis of images. Author

N78-17726# Lockheed Missiles and Space Co., Palo Alto, Calif.
SIMPLE ALGORITHM OF OBJECT RECOGNITION BY MEANS OF INCOMPLETE SPECTRA
A. A. Iakovlev [1978] 6 p refs Transl. into ENGLISH from Opt.-Mekh. Prom. (USSR), no. 10, 1977 p 11-13
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

An algorithm is proposed for object recognition by means of incomplete data. The algorithm is based on comparing the distances of the incomplete pattern being analyzed from a priori mean patterns of each of the possible objects. The distance is calculated in units of possible pattern variations for each object and is averaged for the projection of a multidimensional pattern on some set of two dimensional planes. Author

N78-17727# Lockheed Missiles and Space Co., Palo Alto, Calif.
SELECTION OF THE OPTIMAL ALGORITHM IN A CLASS OF RECOGNITION ALGORITHMS
T. L. Slutskaia [1978] 11 p refs Transl. into ENGLISH from Zh. Vychisl. Mat. i Mat. Fiz. (USSR), v. 17, no. 5, 1977 p 1285-1295
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Weight coefficients gamma sub 1 asterisk,..., gamma sub m asterisk of standard objects from training tables corresponding to the extremal algorithms A asterisk is a member of the set of (A(gamma)) with respect to certain quality criteria were determined explicity for an m parameter family of recognition algorithms set of (A(gamma)), based on the calculation of estimates. An iteration process permitted determination of weight coefficients of the criteria beta 1 asterisk,..., beta sub n asterisk, corresponding to locally-extremal recognition algorithms in addition to the parameters set of (gamma asterisk) was proposed for the case of a Euclidean metric. Author

N78-17728# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
COMMUNICATIONS ORIENTED LANGUAGE (COL): LANGUAGE DEFINITION Final Report, May 1976 - May 1977
Arthur Evans, Jr. and C. Robert Morgan 2 May 1977 335 p refs Supersedes BBN-3261-Pt-2
(Contract DCA100-76-C-0051)
(AD-A047392; AD-E100007; BBN-3534; BBN-3261-Pt-2)
Avail: NTIS HC A15/MF A01 CSCL 09/2

A Communications Oriented Language (COL) is a high order language designed to be maximally effective as a vehicle with which to program communications applications. This document is a description of a design for a COL. The design philosophy and principles that led to the COL are first discussed. Then the language is described, the syntax semi-formally using modified BNF and the semantics informally in English text. Some examples of COL programming are included. An appendix shows how machine-level instructions for a specific machine can be written in the COL, with an example showing interrupt processing. GRA

N78-17729# California Univ., Berkeley. Electronics Research Lab.
AUTOMATED EVALUATION SYSTEMS Final Report, 15 Nov. 1974 - 14 Sep. 1977
C. V. Ramamoorthy 14 Sep. 1977 24 p refs
(Contract N00014-75-C-0485)
(AD-A047653) Avail: NTIS MF A01 CSCL 09/2

The overall objective of the research has been to investigate software development process, automated testing tools, and development techniques for improving reliability of large-scale software systems. In order to accomplish this objective, a preliminary survey on reliability and integrity of large computer programs has been conducted and a scheme has been proposed as a reasonable approach to developing reliable large-scale software. Author (GRA)

N78-17730# Illinois Univ., Urbana-Champaign. Coordinated Science Lab.
NETEDI: AN AUGMENTED TRANSITION NETWORK EDITOR M.S. Thesis
George Daniel Hadden Jul. 1977 67 p refs
(AD-A047506; T-49) Avail: NTIS HC A04/MF A01 CSCL 09/2

A traditional model for recognizing sentences in certain types of languages has been the transition network. One of these can

be drawn on a piece of paper as a group of circles with labeled directed lines connecting them. The circles are called states. Generally, one will be designated the start state and another the final state. The lines are called arcs and represent ways to get from one state to another if the label is matched by the current input word. Every time an arc is taken, the input advances to the next word. GRA

N78-17731# Naval Research Lab., Washington, D. C.
SOME USEFUL PROCEDURES FOR FORTRAN PROGRAMMING ON THE ADVANCED SCIENTIFIC COMPUTER Interim Report
A. K. Jordan and R. H. Lang Oct. 1977 23 p
(AD-A047405; AD-E000024; NRL-MR-3623) Avail: NTIS HC A02/MF A01 CSCL 09/2

The purpose of this report is to provide NRL Research Staff members with a brief, unified introduction to the Advanced Scientific Computer (ASC). It is written from the viewpoint of a research scientist (the user) who knows FORTRAN programming but who is not familiar with the complexities of the ASC and its Job Specification Language (JSL). It is intended to provide the simplest procedures necessary to get on the machine, run FORTRAN programs, and get answers. All of the procedures in this report have been used successfully. The programming consultants of the Research Computation Center contributed most of the information in this report. They are available to provide more detailed information than is given in this summary. GRA

N78-17732# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
COMMUNICATIONS ORIENTED LANGUAGE (COL): LANGUAGE IMPLEMENTATION AND USAGE Final Report, May 1976 - May 1977
C. Robert Morgan and Arthur Evans, Jr. 2 May 1977 181 p refs Prepared in cooperation with Yale Univ.
(Contract DCA100-76-C-0051)
(AD-A047393; AD-E100006; BBN-3533) Avail: NTIS HC A09/MF A01 CSCL 09/2

A Communications Oriented Language (COL) is a high order language designed to be maximally effective as a vehicle with which to program communications applications. A hypothetical compiler for a proposed COL is described. (A companion volume describes the COL language). Possible code-generation strategies for three different computer systems are presented. GRA

N78-17733# Stanford Univ., Calif. Digital Systems Lab.
A STRUCTURAL DESIGN LANGUAGE FOR COMPUTER AIDED DESIGN OF DIGITAL SYSTEMS
W. M. VanCleemput Apr. 1977 37 p refs
(Contract N00014-75-C-0601)
(AD-A048355; SU-SEL-77-014; SU-DSL-TR-136) Avail: NTIS HC A03/MF A01 CSCL 09/2

In this report a language SDL for describing structural properties of digital systems will be presented. SDL can be used at all levels of the design process i.e. from the system level down to the circuit level. The language is intended as a complement to existing computer hardware description languages, which emphasize behavioral description. The language was motivated partly by the nature of the design process. Author

N78-17734# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
CAMAC PROGRAM SYSTEM (CSYS). REFERENCE MANUAL [CAMAC-PROGRAMM-SYSTEM (CSYS) REFERENZE MANUAL]
Hubert Huebner Apr. 1977 113 p refs In GERMAN Supplement to MPIS-8/1977; see N78-14833
(MPIS-8/1977) Avail: NTIS HC A06/MF A01; Max-Planck-Inst. Fuer Stroemungsforsch., Goettingen, West Ger. DM 19, 50

The operation of the CAMAC program system (CSYS) is detailed. The operating mode of the programs and the required data are described as well as the necessary programming details for producing a CSYS program. The following topics are highlighted: CAMAC processor (CAMAC interpreter and code generator), interrupt processor, control element handling, and auxiliary programs. ESA

N78-17735# International Institute for Applied Systems Analysis, Laxenburg (Austria).
DUAL SYSTEMS OF DYNAMIC LINEAR PROGRAMMING
A. Propoi Apr. 1977 28 p refs
(IIASA-RR-77-9) Avail: NTIS HC A03/MF A01

A pair of dual problems were formulated and the relations between them established. Optimality conditions, including the maximum principle for primal and the minimum principle for dual problems were obtained. Results were first formulated for a canonical form of dynamic linear programming after which modifications and particular cases were considered.Author (ESA)

N78-17736# Illinois Univ., Urbana-Champaign.
REPORT ON THE WORKSHOP FOR SOFTWARE COORDINATION WITHIN THE UNIVERSITY ENVIRONMENT
L. A. Lopez Oct. 1977 36 p Workshop held at Monticello, Ill., 16-17 Nov. 1976
(Grant NSF ENG-75-17138)
(PB-273686/6) Avail: NTIS HC A03/MF A01 CSCL 09B

The problem of costs associated with the development and dissemination of computer software were investigated primarily from the point of view of engineering research in the university environment. The consensus of attendees was that the benefit to cost ratio of university research projects which were heavily dependent on computer utilization could be increased considerably if some type of university oriented software coordination effort were initiated. GRA

N78-17737# Public Technology, Inc., Washington, D. C. Information Systems Group.
GUIDE TO THE PREPARATION OF SYSTEM USER'S DOCUMENTATION Final Report
1977 21 p
(Contract HUD-H-2341)
(PB-274169/2; HUD/RES-1180) Avail: NTIS HC A02/MF A01 CSCL 09B

Software documentation as an aid in the transfer of local government information systems is discussed. Guidelines for documentation oriented to nontechnical local government audiences are provided. Three documents are described, addressing respectively (1) the chief administrative officer and elected officials, (2) department heads affected by the system, and (3) functional personnel involved in everyday use of the system. The documents would cover the system's purpose and scope, costs and benefits, organizational context, inputs and outputs, and operating procedures. GRA

N78-17738# Public Technology, Inc., Washington, D. C. Information Systems Group.
GUIDE TO THE PREPARATION OF SYSTEM DESIGN AND PROGRAM DOCUMENTATION Final Report
1977 66 p
(Contract HUD-H-2341)
(PB-274168/4; HUD/RES-1179) Avail: NTIS HC A04/MF A01 CSCL 09B

Software documentation as an aid in the transfer of local government information systems is discussed. Guidelines for the documentation of system design, job streams, and programs are provided. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N78-17739 Stanford Univ., Calif.
BROADCAST PROTOCOLS IN PACKET SWITCHED COMPUTER NETWORKS Ph.D. Thesis
Yogen Kantilal Dalal 1977 264 p
Avail: Univ. Microfilms Order No. 77-25653

The design and analysis of broadcast routing algorithms for use in store-and-forward packet switched computer networks is investigated. Five alternatives to transmitting separately addressed packets from the source to the destinations are examined. The algorithms are compared qualitatively in terms of memory requirements, ease of implementation, adaptiveness to changing network conditions, and reliability. The algorithms are also compared quantitatively in terms of the number of packet copies generated to perform broadcast and the delays to propagate

the packet to all destinations. Applications for broadcast protocols in distributed computing environments are described. We have examined the tradeoffs between global and subgroup broadcast routing. Dissert. Abstr.

N78-17740 Carnegie-Mellon Univ., Pittsburgh, Pa.
ON THE DESIGN AND VERIFICATION OF OPERATING SYSTEMS Ph.D. Thesis
Lawrence Flon 1977 122 p
Avail: Univ. Microfilms Order No. 77-27722

Mathematical program verification is applied to systems programs. The design methodology is based upon the use of abstract data types and the construction and verification of both specifications and implementations for them. The specification technique appeals to various mathematical structures to describe an abstract state for objects of a given type. The correctness of the formal specifications is cast in terms of the proof of certain invariant properties of the abstract state. The applicability of the methodology to operating systems is explored. It is found that a hierarchical decomposition is most amenable to verification, and that the implementation language used is a function of that hierarchy. The example of a process dispatcher module of a hypothetical operating system is used to illustrate the process of design, specification, implementation, and verification using the methodology. Different approaches to the total correctness of parallel programs are treated. Dissert. Abstr.

N78-17741# Computer Corp. of America, Cambridge, Mass.
DATACOMPUTER AND SIP OPERATIONS Quarterly Technical Report, Jul. - Sep. 1977
Donald E. Eastlake, III 30 Oct. 1977 78 p refs
(Contract MDA903-77-C-0183; ARPA Order 3346)
(AD-A047661; CCA-77-13) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report describes very large on-line data storage and retrieval services over the Arpanet to support seismic data activity and general use. Use of these services continued to grow in the Arpanet community and additional applications are under active investigation. GRA

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N78-17742 Stanford Univ., Calif.
A FRAMEWORK FOR SPEECH UNDERSTANDING Ph.D. Thesis
William Hamilton Paxton 1977 283 p
Avail: Univ. Microfilms Order No. 77-25713

State of the art advances in computational linguistics, artificial intelligence, systems programming, and speech science were used in the design, implementation, and testing of a computer system which uses grammatical, semantic, and contextual constraints rather than acoustic information alone. A central role is given to the input-language definition which is based on augmented phrase structure rules that specify the possible constituents of a phrase and compute attributes and factors. The phrases and attributes are manipulated by a system executive which acts as a parser and controls the overall activity of the system by setting priorities on the basis of linguisitic and acoustic judgments. Dissert. Abstr.

N78-17743 Stanford Univ., Calif.
OPTIMAL CONTROL IN MARKOV POPULATION PROCESSES Ph.D. Thesis
James Michael Moore 1977 142 p
Avail: Univ. Microfilms Order No. 77-25704

The structure of the population process and the corresponding reward process were examined in a no-control context. Then a formulation of the stochastic control problem for Markov population processes was developed. The notion of separability was introduced. A simplifying two stage decomposition procedure was introduced for separable unconstrained problems. For the nonseparable and/or constrained finite horizon problem, an algorithm was developed based on a simplifying assumption. A method for assessing the validity of the assumption for any particular problem parameter set was provided. An exploration was made of control policy issues for the class of nonseperable and/or constrained infinite horizon problems. Limit policies were shown to exist in the discounted infinite horizon case. Dissert. Abstr.

N78-17744 Purdue Univ., Lafayette, Ind.
ANALYSIS AND DESIGN OF LINEAR MULTIVARIABLE CONTROL SYSTEMS WITH EMPHASIS ON INTEGRITY Ph.D. Thesis
Gregory Dean Martin 1977 292 p
Avail: Univ. Microfilms Order No. 77-30106

A procedure was developed for mapping the stability region in gain space for a linear multivariable control system. Two new interpretations of the return difference determinant were developed, allowing the stability region to be determined accurately by means of a straightforward algorithm. The mapping methods developed offer the designer key information toward altering the stability region by compensator design. The design process allows flexibility not present in existing design methods. This flexibility is particularly valuable when integrity is a primary design consideration. Dissert. Abstr.

N78-17745 Washington Univ., Seattle.
DYNAMIC AND ADAPTIVE CONTROL OVER THE DEMAND-SATURATION OF COMPUTATION RESOURCES IN MULTI-USER ENVIRONMENT Ph.D. Thesis
Hun Bae Son 1977 270 p
Avail: Univ. Microfilms Order No. 77-28344

Avoidance of undue contention for the services of nonsharable computation resources, dynamic resource contention index class reconfigurations, and conversion of a multiple job-step program into a single job-step program are examined in terms of correctly executing a user program as quickly as possible. Implementation programs which effectively verify this possibility are developed. The matching concept of individualizing and dynamically adapting a user program to the current resource availability status of the operating system is emphasized. Dissert. Abstr.

N78-17746* National Aeronautics and Space Administration, Washington, D. C.
POSSIBILITIES FOR IMPROVING THE EFFICIENCY OF LINEAR ERROR-CORRECTING CODES
R. R. Varshamov Nov. 1977 9 p ref Transl. into ENGLISH form Dokl. Akad. Nauk SSR (USSR), v. 223, no. 1, 1975 p 60-63 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-2790)
(NASA-TM-75204) Copyright. Avail: Issuing Activity CSCL 09B

Results are presented in the form of 14 theorems specifying sufficient conditions under which it is possible to construct new more efficient single- and multi error correcting codes from existing ones when the method used to construct existing codes is known. Author

N78-17747# Maryland Univ., College Park. Computer Science Center.
SHAPE COMPLETION
Wallace Rutkowski Aug. 1977 35 p
(Grant AF-AFOSR-3271-77)
(AD-A047682; TR-564) Avail: NTIS HC A03/MF A01 CSCL 09/4

This report describes some simple techniques for smoothly filling in gaps in object contours. The first technique considered was recently proposed by Ullman; it constructs the completion of the contour using two arcs of circles that are tangent to the gap ends and to each other, and that have minimum total curvature. An analysis of this technique is presented, and examples of its use are given. A second technique uses cubic polynomial completions; when suitably constrained, this technique yields very reasonable completions. Author (GRA)

N78-17748# California Univ., Los Angeles. Dept. of Engineering Systems.
DYNAMIC SYSTEMS CONTROL THEORY Final Report, 1 Dec. 1976 - 31 Aug. 1977

Cornelius T. Leondes 31 Aug. 1977 12 p refs
(Grant AF-AFOSR-2958-76)
(AD-A047467; AFOSR-77-1282TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The areas of research cover a diverse spectrum for deterministic and stochastic differential games through identification and filtering all the way to system synthesis. For further information on details refer to the final report. Author (GRA)

N78-17749# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
CONTROL OF DYNAMICAL SYSTEMS Annual Progress Report, 1 Sep. 1976 - 31 Aug. 1977
H. T. Banks 7 Oct. 1977 32 p refs
(Grant AF-AFOSR-3092-76)
(AD-A047465; AFOSR-77-1281TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

Contents: Numerical Methods for Optimal Control of Systems with Delays; Bifurcation Theory; Stability of Functional Differential Equations; Stability of Feedback Structures (Control Generators); Stability and Control of Discrete Processes; and Stability of Nonautonomous Retarded Differential Equations. GRA

N78-17750# Maryland Univ., College Park. Computer Science Center.
UNDERSTANDING STICK FIGURES
Nov. 1977 41 p
(Contract N00014-76-C-0477)
(AD-A047817; TR-603) Avail: NTIS HC A03/MF A01 CSCL 06/4

This paper describes a framework for a computer model of stick figure understanding in which semantic inferences are made from body postures. Stick figures of humans are shown to provide a rich environment in which to develop and test techniques and methods of visual understanding. The computer system which will implement the theory is called SKELETUN. The notion of a hierarchical organization of recognition packets running in parallel is introduced. This paradigm is applied to an example. In addition, it is shown how SKELETUN relies on interaction between model-driven and data-driven modes. Author (GRA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N78-17751 Cincinnati Univ., Ohio.
MULTIVALENT LINEARLY ACCESSIBLE FUNCTIONS AND CLOSE-TO-CONVEX FUNCTIONS Ph.D. Thesis
Abdallah Khalil Lyzzaik 1977 108 p
Avail: Univ. Microfilms Order No. 77-23062

The concept of a linearly accessible domain introduced by Biernacki is generalized, and the class G(p), p a positive integer, of p-valent linearly accessible functions is defined. The Uniformization theorem plays a central role to conclude four other theorems. Dissert. Abstr.

N78-17752 Columbia Univ., New York.
NORMALIZATION OF DIFFERENTIAL EQUATIONS DEFINING A CR STRUCTURE Ph.D. Thesis
Hing-Sun Luk 1977 86 p
Avail: Univ. Microfilms Order No. 77-24107

Let Q sub k be the k-strongly pseudoconvex real hyperquadratic in C sup n, and H sub k be the isotropy group of the origin q(0) in the automorphism group of Q sub k. Let script E Q sub k be the set of all germs of k-strongly pseudoconvex CR structures (on Q sub k) at q(0). Let script D Q sub k be the group of all germs of diffeomorphisms which map neighborhoods of q(0) into Q sub k and leave q(0) fixed. Script D Q sub k acted in a natural way on script E Q sub k. Regard H sub k as a subgroup of script D Q sub k. A subset script r Q sub k script E Q sub k was constructed, which was invariant under the action of H sub k, such that each element in script E Q sub k can be carried into script r Q sub k by the action of some element g in script D Q sub k. Dissert. Abstr.

N78-17753 Colorado Univ., Boulder.
LIE ALGEBRAS OF CHARACTERISTIC THREE WITH NONDEGENERATE TRACE FORM Ph.D. Thesis
Frederick William Humburg 1977 61 p
Avail: Univ. Microfilms Order No. 77-24230

Let an algebra be of classical type if it satisfies the axioms of Mills and Seligman as modified by Brown. Assume that the base field of all algebras is algebraically closed. It is shown that a Lie algebra which is perfect and has a nondegenerate trace form is the direct sum of an algebra of classical type and copies of a particular seven-dimensional simple algebra. By a result of Brown, the algebra of classical type must be a direct sum of simple algebras; the fundamental system of roots of each simple algebra in the sum must belong to an explicit list of systems. All direct summands also possess nondegenerate trace forms. Of the possible systems of roots, there are four infinite families, a member of any of which determines a unique (up to isomorphism) Lie algebra. Each of these algebras is here shown to have a nondegenerate trace form. Dissert. Abstr.

N78-17754 Rutgers Univ., New Brunswick, N. J.
ON RATIONAL SOLUTIONS OF CERTAIN WEIERSTRASS EQUATIONS Ph.D. Thesis
Charles Freund Schwartz 1977 80 p
Avail: Univ. Microfilms Order No. 77-25016

The group not contained in (t) rational solutions of the Weierstrass equation Y squared = x(x-1) (x-t squared-c), c does not equal 0,1, is generated by its torsion subgroup together with one element of infinite order by defining a bilinear form, I, on the group, and showing that 4I-(P sub o, P sub o) = 1. It is also shown that 4I(P,Q) takes integer values for P and Q in the group and that the rank of the group is 1. Linearly independent not contained in (u) r rational solutions are developed for the Weierstrass equation Y squared = 4X cubed-3u(Au-B) 2X-u(Au-B) cubed. It is shown that the r solutions form a maximal linearly independent subset of the group of solutions. In order to prove independence a Picard-Fuchs operator is calculated and a group homomorphism is defined. The rank of the group is shown to be r in each case. Results are used to calculate the image of a monodromy map. Dissert. Abstr.

N78-17755 Kentucky Univ., Lexington.
THE TRACES OF HOLOMORPHIC FUNCTIONS ON REAL SUBMANIFOLDS Ph.D. Thesis
Gary Alvin Harris 1977 38 p
Avail: Univ. Microfilms Order No. 77-23507

Of interest is the following: given a real submanifold M of complex Euclidean n-space and a function f defined on M, f is the restriction to M of an ambient holomorphic function. It seems quite untractable for a general smooth submanifold, thus only real-analytic submanifolds are considered. If the given submanifold is a C.R. submanifold the question has already been answered completely. Namely, f is the restriction of a holomorphic function if and only if f is a C.R function. The more general situation is of interest in which M need not be a CR-submanifold; that is, the dimension of the complex tangent space to M may vary. In case the dimension of M is larger than or equal to n and M is generic in some neighborhood of each point off its CR singularities. Dissert. Abstr.

N78-17756 Brandeis Univ., Waltham, Mass.
FOLIATIONS AND PLANE FIELDS ON COMPACT MANIFOLDS Ph.D. Thesis
Bruce Franklin Golbus 1977 121 p
Avail: Univ. Microfilms Order No. 77-22811

The general existence problem for C infinity foliations on connected, compact C infinity n-manifolds X sup n was studied. Cohomological invariants associated to the singularities of a (smooth) codimension q Haefliger structure F were defined whose vanishing was shown to be a necessary condition for deforming F to a codimension q foliation on X sup n. An analogous approach to vector bundle maps was then utilized to prove a general theorem concerning the possibility of embedding a vector bundle in the tangent bundle of X sup n, and applications to the plane field problem are given. In addition, using a partial extension of the Thom transversality theorem to Haefliger structures, geometric realizations of the singularity classes associated to F were constructed. Dissert. Abstr.

N78-17757 George Washington Univ., Washington, D. C.
INTEGRAL GENERALIZED INVERSES OF INTEGRAL MATRICES Ph.D. Thesis
Daniel Rucker Batigne 1977 47 p
Avail: Univ. Microfilms Order No. 77-26457

Let A be a rectangular matrix with entries from a field F having an involutory automorphism sigma : x approaches the limit x bar and let A Hermitian conjugate of matrix A denote the conjugate transpose of A with respect to sigma; that is, Hermitian conjugate of matrix A=(a bar sub ji) if A=(a sub ij). A generalized inverse of A, denoted by excited A, is a matrix X which satisfies the four equations AXA=A, XAX=X, (AX) asterisk=AX,(XA)asterisk=XA. The concept of a pseudo-regular matrix was introdued as a matrix which, after a suitable permutation of its rows and columns, was the direct sum of a non-singular matrix M sub A and a zero matrix. Defining a matrix to be integral if its entries are all rational integers, it is shown that only those integral matrices which were pseudo-regular and for which det M sub A = 1 have an integral generalized inverse. It is then shown how that generalized inverse was calculated, in this case, using the inverse of Mi sub A.
Dissert. Abstr.

N78-17758 Wisconsin Univ., Madison.
ENERGY DECAY ESTIMATES AND CONTROL THEORY FOR THE WAVE EQUATION IN A BOUNDED DOMAIN Ph.D. Thesis
Goong Chen 1977 238 p
Avail: Univ. Microfilms Order No. 77-19703

Improvement upon the perturbation method and a complete account for the justification of the biorthogonal expansion is shown, and the uniform exponential decay of energy for the wave equation in a star-complemented sector is discussed. Complete controllability for the wave equation in a hypersphere or a star-complemented sector was then obtained. Existence, uniqueness, and regularity for mixed initial boundary value problems and exponential decay of energy from the semigroup point of view are presented. Dissert. Abstr.

N78-17759 Wisconsin Univ., Madison.
TOPOLOGICAL PROPERTIES OF ALGEBRAIC VECTOR FIELDS Ph.D. Thesis
Carmen Charles Chicone 1977 127 p
Avail: Univ. Microfilms Order No. 77-19704

A homogeneous polynomial of degree three in three variables gave an algebraic vector field on the sphere by orthogonal projection of its gradient. In the plane a quadratic system of differential equations was an algebraic vector field. Several properties of such systems were investigated: structural stability relative to perturbations in the coefficient space, classification up to topological conjugacy, and existence of orbits connecting critical points. Dissert. Abstr.

N78-17760 Stanford Univ., Calif.
STEPSIZE SELECTION FOR SELF-SCALING VARIABLE METRIC ALGORITHMS Ph.D. Thesis
Abdalla Mohamed Abdelkader 1977 125 p
Avail: Univ. Microfilms Order No. 77-25637

A formula for stepside selection is derived, using the self-scaling variable metric (SSVM) family of quasi-Newton algorithms to update the inverse Hessian approximation. The main theme of this work is to favorably affect the limiting behavior of the algorithm, i.e., its convergence properties local to the minimum, and attempt to extend that behavior away from the minimum. The SSVM is applied to the minimization of a positive definite quadratic function. The limiting behavior of the SSVM is extensively investigated to derive results relevant to stepsize selection. Dissert. Abstr.

N78-17761 Florida Univ., Gainesville.
A SUBGRADIENT ALGORITHM FOR CERTAIN MINIMAX AND MINISUM PROBLEMS Ph.D. Thesis
Jacques Antonin Chatelon 1977 103 p
Avail: Univ. Microfilms Order No. 77-25918

Problems consisted of minimizing the maximum of a finite collection of functions, where each function was the sum of a finite number of basic functions, called locally finitely subdifferentiable functions. Problems included both the minisum and minimax problems of location theory, as well as the linear approximation problem. Problems with differentiable convex constraints were dealt with, and a subgradient algorithm was developed, and convergence to a near optimal point was proved. The effectiveness of the subgradient algorithm is presented, using numerical solutions of several location problems and linear approximation problems. Dissert. Abstr.

N78-17762 Cincinnati Univ., Ohio.
CENTER VALUED WEIGHTS IN VON NEUMANN ALGEBRAS Ph.D. Thesis
Nazanin Azarnia 1977 91 p
Avail: Univ. Microfilms Order No. 77-29701

A center-valued weight on a von Neumann algebra script A with center script Z was defined to be a script Z linear map on the positive part of script A into script Z(+) the set of positive measurable functions on a locally compact space Z, which contained the positive part of script Z, and where script Z was identified with the space of all essentially bounded complex valued measurable functions. Properties of unbounded densely defined script Z linear or conjugate script Z linear operators in a KH module analogous to those known for unbounded operators in a Hilbert space were derived. The concept of a generalized KH algebra is presented, and it is shown that with each generalized KH algebra a one-parameter group of automorphisms is associated, called the modular automorphism group. Dissert. Abstr.

N78-17763 Yale Univ., New Haven, Conn.
SEPARABLE JORDAN ALGEBRAS OVER COMMUTATIVE RINGS Ph.D. Thesis
Robert Alan Bix 1977 118 p
Avail: Univ. Microfilms Order No. 77-27803

All algebras are unital and are defined over a commutative ring containing 1/2. A Jordan algebra is defined to be separable if its unitial universal multiplication algebra is a separable associative algebra. The functorial properties of separable algebras were noted and a one-to-one correspondence was established between the ideals of a separable algebra and the ideals of its center. A separable algebra decomposes into a direct sum of ideals corresponding to the isomorphism classes of finite dimensional simple Jordan algebras over an algebraically closed field. An analogous decomposition holds for separable associative algebras with involution and the two types of decomposition are related. These decompositions were used to study the special universal envelope and the universal multiplication algebra of a central separable Jordan algebra. Dissert. Abstr.

N78-17764 Carnegie-Mellon Univ., Pittsburgh, Pa.
FINITE ELEMENT APPROXIMATION OF A NONLINEAR DIFFUSION PROBLEM Ph.D. Thesis
Benayahu Neta 1977 70 p
Avail: Univ. Microfilms Order No. 77-27723

The nonlinear diffusion problem Au is identical to -div (absolute value of grad u sup (p - 2) grad u) = f in omega and u = 0 on delta omega where 2< or equal to p < infinity, omega was an open bounded subset of IR (to the n power) with boundary delta omega. The evolution equation u sub t + Au = f is also described and error estimates are presented.
Dissert. Abstr.

N78-17765 Oregon State Univ., Corvallis.
THE EFFICIENCY OF SMOOTH GOODNESS-OF-FIT TESTS Ph.D. Thesis
Kenneth James Kopecky 1977 143 p
Avail: Univ. Microfilms Order No. 77-29417

Neyman (1939) obtained a quadratic score statistic for testing simple goodness-of-fit hypotheses in a family of smooth alternatives. Javitz (1975) and Thomas and Pierce (1977) described the appropriate quadratic score statistic for composite goodness-of-fit hypotheses against smooth alternatives. These statistics, are described, and matrices needed for their application to some examples are calculated. The possibility of applying the procedures to testing multivariate normality was considered and difficulties were seen to arise. Noncentrality parameters for power calculations were derived, and a measure of asymptotic relative efficiency of the smooth tests with other tests based on quadratic score statistics was derived. This permits comparison of the smooth tests with sq X goodness-of-fit tests of the Pearson

type as well as locally best tests for parametric alternatives.
Dissert. Abstr.

N78-17766 Clemson Univ., S.C.
A COMPARISON OF SOME BIASED ESTIMATORS IN REGRESSION ANALYSIS Ph.D. Thesis
Amitava Mitra 1977 106 p
Avail: Univ. Microfilms Order No. 77-29692

Alternative estimators to the ordinary least squares estimator were considered. Ridge type estimators and some of the estimators proposed in the context of the estimation of the mean of a multivariate normal distribution were studied. The squared loss function was studied, in depth, in the orthogonal case, for ridge estimators. A comparative study of the performance of the various estimators was made through a Monte-Carlo simulation. The controlled parameters used in the simulation study were the degree of multicollinearity, the number of independent variables, the variance of the error term, and the vector of regression coefficients. From the results of the simulation, favorable conditions under which some of the estimators may be used, are discussed. It was found that the two new proposed estimators are quite robust. Dissert. Abstr.

N78-17767 Iowa State Univ. of Science and Technology, Ames.
ESTIMATION IN NONSTATIONARY TIME SERIES Ph.D. Thesis
David Paul Hasza 1977 130 p
Avail: Univ. Microfilms Order No. 77-29838

The least squares estimator is investigated, and is obtained from the regression of Y sub t on Y sub t-1, Y sub t-2,..., Y sub t-p for t = 1,2,...,n. The regression estimator and the regression F-statistics for testing linear hypotheses are also investigated. Particular attention is given to processes with /m sub 1/>1 and to processes with m sub 1 = m sub 2 = ... = m sub q = 1. Processes which contain a deterministic nonstationary component in the form of a time trend are investigated. Hypothesis testing and forecasting procedures are considered. The distributions likelihood ratio tests for certain hypothesized parameter configurations are investigated via the Monte Carlo method.
Dissert. Abstr.

N78-17768 Yale Univ., New Haven, Conn.
STAR-FINITE PROBABILITY THEORY Ph.D. Thesis
Robert Murdoch Anderson 1977 121 p
Avail: Univ. Microfilms Order No. 77-27801

Significant probabilistic constructs are demonstrated to be successfully treated through star-finite techniques by exhibiting star-finite models for Brownian motion and Ito integrals. Loeb measures play a crucial role in these constructions. A systematic development is given for the basic techniques required for the general application of star-finite methods in probability theory. Included are representations of arbitrary Radon spaces and a characterization of weak convergence in star-finite terms. Probabilistic concepts are replaced by their star-finite counterparts. Proof of a formulation of Edgeworth's conjecture which is simpler and substantially more general is stated. Dissert. Abstr.

N78-17769*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SOME NEW NYSTROM INTEGRATORS Shuttle Program
W. M. Lear Feb. 1978 19 p refs
(NASA-TM-79346; JSC-13863; Rept-78-FM-11) Avail: NTIS HC A02/MF A01 CSCL 12A

Nystrom integrators were self starting integrators used to integrate the second order, vector, differential equations the second derivative of x factorial = f factorial (t, x factorial) and the second derivative of x factorial = f factorial (t, x factorial, first derivative of x factorial). Nystrom integrator parameters were defined by a set of nonlinear constraint equations and frequently there were more parameters than there were equations. Additions are included for higher order integrations when the second derivative of x factorial = f factorial (t). Author

N78-17770# Yale Univ., New Haven, Conn. Dept. of Computer Science.
THE MODIFIED CONJUGATE RESIDUAL METHOD FOR PARTICLE DIFFERENTIAL EQUATIONS
R. Chandra, S. C. Eisenstat, and M. H. Schultz May 1977 25 p refs
(Contracts N00014-76-C-0277; F49620-77-C-0037)
(AD-A047727; RR-107) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper presents the Modified Conjugate Residual (MCR) Method, a stabilized version of Luenberger's Method of Conjugate Residuals, for solving large sparse systems of linear equations. This iterative method has special significance when the system is not positive definite so that methods like Conjugate Gradients are inapplicable. In the special case when the system is positive definite, MCR reduces to one of the family of general conjugate gradient methods discussed by Hestenes. GRA

N78-17771# Yale Univ., New Haven, Conn. Dept. of Computer Science.
FINITE ELEMENT METHODS FOR SPHERICALLY SYMMETRIC ELLIPTIC EQUATIONS
S. C. Eisenstat, R. S. Schreiber, and M. H. Schultz May 1977 15 p refs Presented at the IMACS Intern. Symp. on Computer Methods for Partial Differential Equations, 2d, Bethlehem, Pa., 22-28 Jun. 1977
(Contracts N00014-76-C-0277; NSF MCS-76-11450)
(AD-A047721; RR-109) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper considers the numerical solution of elliptic partial differential equations in spherical domains. When all the functions involved are spherically symmetric (that is, they depend only on distance from the center of the domain), the problem can be replaced by an equivalent two-point boundary value problem. The resulting problem is singular, but nevertheless has a smooth solution. It should therefore be possible to approximate the solution accurately using the Rayleigh-Ritz Galerkin method with a piecewise polynomial subspace on a quasiuniform mesh. Optimal-order error bounds will be obtained, showing that this procedure is theoretically well-founded. Instead of the usual Sobolev norms, norms are used which are appropriate to the original n-dimensional setting of the problem. GRA

N78-17772# Yale Univ., New Haven, Conn. Dept. of Computer Science.
FINITE ELEMENT METHODS OF SINGULAR TWO-POINT BOUNDARY VALUE PROBLEMS Ph.D. Thesis
Robert Samuel Scheiber Sep. 1977 151 p refs
(Contracts N00014-76-C-0277; NSF MCS-76-11460)
(AD-A047726; RR-115) Avail: NTIS HC A08/MF A01 CSCL 12/1

Until quite recently, few effective numerical solution techniques were known for solving two-point boundary value problems for the equation $-d/dx(p(x)du/dx) + qu = f$, $0 < x < 1$, $p(0) = 0$. This dissertation analyzes several new finite element methods for approximating the solution of this problem, and presents new analysis for some known methods. GRA

N78-17773# Yale Univ., New Haven, Conn. Dept. of Computer Science.
MINIMAL STORAGE BAND ELIMINATION
S. C. Eisenstat, M. H. Schultz, and A. H. Sherman (Texas Univ., Austin) 15 Apr. 1977 18 p refs Presented at Symp. on High Speed Computer and Algorithm Organization, Urbana-Champaign, Ill., 13-15 Apr. 1977
(Contracts N00014-76-C-0277; F49620-77-C-0037; NSF MCS-76-11460)
(AD-A047723; RR-105) Avail: NTIS HC A02/MF A01 CSCL 09/2

A variation of Gaussian elimination is presented for solving band systems of linear equations on computers with limited core storage, without the use of auxiliary storage such as disk or tape. The method is based on the somewhat unusual idea of recomputing rather than saving most nonzero coefficients in the reduced triangular system, thus trading an increase in work for a decrease in storage. For a five-point problem on an n x n grid, the storage required is approx. n-squared versus approx. n-cubed for band elimination, while surprisingly the work required at most doubles. Author (GRA)

N78-17774# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
FACTORING NUMBERS IN O (LOG N) ARITHMETIC STEPS

Adi Shamir Nov. 1977 18 p refs
(Contracts N00014-76-C-0366; NSF MCS-77-19754)
(AD-A047709; MIT-LCS-TM-91) Avail: NTIS HC A02/MF A01 CSCL 12/1

A non-trivial factor of a composite number n can be found by performing arithmetic steps in a number proportional to the number of bits in n, and thus there are extremely short straight-line factoring programs. However, this theoretical result does not imply that natural numbers can be factored in polynomial time in the Turing-Machine model of complexity, since the numbers operated on can be as big as 2 to the power c n-squared, thus requiring exponentially many bit operations. GRA

N78-17775# Illinois Univ., Urbana-Champaign. Coordinated Science Lab.
AN ALGEBRA FOR THE REALIZATION OF SWITCHING FUNCTIONS USING A CERTAIN TYPE OF MOS
Ravindra Nair and Gernot Metze Jul. 1977 34 p refs
(Contract DAAB07-72-C-0259)
(AD-A047352; R-775; UILU-ENG-77-2222) Avail: NTIS HC A03/MF A01 CSCL 12/1

Switching functions may be realized using a certain type of MOSFET circuit package, similar to the Fairchild 3102 package. This paper outlines the conditions that must be satisfied by a switching function so that it may be realized in a series-parallel form or in a bridge form using the least number of MOS elements in the package. Algorithms are given to obtain near optimal realizations when minimal realizations do not exist.Author (GRA)

N78-17776# Naval Underwater Systems Center, New London, Conn.
POSITIVE DEFINITE SPECTRAL ESTIMATE AND STABLE CORRELATION RECURSION FOR MULTIVARIATE LINEAR PREDICTIVE SPECTRAL ANALYSIS
Albert H. Nuttall 14 Nov. 1977 54 p refs
(AD-A048035; NUSC-TR-5729) Avail: NTIS HC A04/MF A01 CSCL 12/1

The questions regarding a positive definite spectral estimate and a stable correlation recursion are answered in the affirmative for the particular choice of weighting recommended in the above reference. A modified and updated FORTRAN program for multivariate spectral analysis, which incorporates calculation of the correlation matrices via recursion, and the aliased correlation matrices via a fast Fourier transform (FFT), are included. GRA

N78-17777*# Yale Univ., New Haven, Conn. Dept. of Statistics.
HARMONIC REGRESSION
Francis J. Anscombe Dec. 1977 27 p refs Presented at 3d ERDA Statist. Symp., Richland, Wash., 26 Oct. 1977 Sponsored in part by NASA, Army and Air Force
(Contract N00014-75-C-0563; NR Proj. 042-242)
(NASA-CR-155747; AD-A048218; TR-44) Avail: NTIS HC A03/MF A01 CSCL 12/1

Ordinary linear regression, by the method of least squares, is used to determine a linear relation subsisting between given independent observations of two or more variables. An analogous problem for time series is to determine a linear relation subsisting between two or more given stationary series. The linear relation may take the form that one series is a linear filtering of the other series, plus a stationary error process. The coefficients of the filter can be determined directly by multiple regression in the time domain, but there are difficulties. An easier procedure, leading to more intelligible results, is to estimate the Fourier transform of the coefficients of the filter for each predictor series (conveniently expressed as a gain function and a phase-shift function) by simpler regression calculations in the frequency domain. The procedure is illustrated by a study of interrelationship of an annual series of output of U.S. copper mines from 1860 to 1975, and two annual economic series relating to the same time period, namely a series of copper prices at New York and a series of total dollar value of general imports of merchandise into the U.S. Author (GRA)

N78-17778# California Univ., Berkeley. Operations Research Center.
A DYNAMIC FORMULATION OF THE LAW OF DIMINISHING RETURNS
Rolf Faere Oct. 1977 26 p refs
(Contract N00014-76-C-0134)
(AD-A048056; ORC-77-29) Avail: NTIS HC A02/MF A01 CSCL 12/1

Based on an axiomatic framework for a dynamic production structure a law of diminishing returns is derived. This law shows that for output to be bounded in rate (i.e., norm) and in time availability (i.e., support) it is necessary and sufficient that an essential subvector of inputs is likewise bounded in rate and time availability. Author (GRA)

N78-17779# International Institute for Applied Systems Analysis, Laxenburg (Austria).
ADAPTIVITY AND STABILITY OF TIME SERIES MODELS
Johannes Ledolter Jun. 1977 23 p refs
(IIASA-RM-77-35) Avail: NTIS HC A02/MF A01

The effect of interventions on economic variables in the presence of a time dependent noise structure was modelled. Forecasts from such models were derived. It is discussed whether forecasts from ARIMA time series models are adaptive with respect to interventions such as changes in the level or outliers. An overall criterion to test the stability of the parameters in ARIMA models was derived and applied to three Austrian macroeconomic sequences. Author (ESA)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N78-17780 Carnegie-Mellon Univ., Pittsburgh, Pa.
STOCHASTIC ITO-VOLTERRA EQUATIONS Ph.D. Thesis
Marc Aron Berger 1977 145 p
Avail: Univ. Microfilms Order No. 77-20610

Existence, uniqueness and perturbation results are presented for the general Ito-Volterra equation, relative to a fixed one-parameter Brownian motion. Because of a kernel-type representation of square integrable nonanticipating processes, which follows from a result by Cameron and Martin, this equation actually encompasses the most general square integrable history of the Brownian motion. And this justifies the restriction to the Volterra equation, instead of the more general Fredholm equation. Two different techniques are presented for analyzing these equations. The first technique entails the development of a new type of stochastic integral, the integrated of which is measurable with respect to a certain sigma-field which anticipates the Brownian motion. A Fubini-type result, referred to as the Correction Formula, relates this integral to an Ito integral. As a corollary of this result, the solution of the linear Ito-Volterra equation is derived in terms of a resolvent kernel and a shifted Brownian motion. Dissert. Abstr.

N78-17781 Nebraska Univ., Lincoln.
FRACTIONAL DERIVATIVES AND ORDERS OF DISTRIBUTIONS Ph.D. Thesis
William Tadd Franke 1977 129 p
Avail: Univ. Microfilms Order No. 77-23139

The fractional derivative is generalized to distributions and fractional order of distributions is defined. In particular, distributions may have order r, r + or infinity for any non-negative real number r. The relationship between measures and fractional orders of periodic distributions is determined, with examples showing that each result is the best possible. The major result is that there are pseudomeasures will all fractional orders between 0 and 1/2 +, and that these are the only possible orders for pseudomeasures. This indicates several pathologies in the concept of order, among them, o(T*S) may be much less than o(T) + o(S) and that there is no exact relationship between rate of decrease of Fourier coefficients and fractional order. The fractional derivative is extended to Rn and a collection of nested Banach spaces, is defined. Dissert. Abstr.

N78-17782 Virginia Polytechnic Inst. and State Univ., Blacksburg.
DESIGNS FOR THE DETECTION OF INADEQUACY IN FACTORIAL MODELS Ph.D. Thesis

Max Duane Morris 1977 172 p
Avail: Univ. Microfilms Order No. 77-24516

The lambda sub 2-criterion was applied to designs for factorial experiments. Main effects designs which are lambda sub 2-optimal for detecting two-factor interactions were investigated. An alternate motivation for use of the criterion was developed for 2 to the k power factorial experiments. That optimality is invariant to selection of full-rank parameterization. An upper bound for the value of tr T to the -1 power was developed, and it is shown that a factorial design attains this bound if and only if it is an orthogonal array of strength three Using computer search techniques, several lambda sub 2-optimal designs were constructed for 2 to the k power and 3 to the k power experiments. Considerable evidence to support the conjecture that lambda sub 2-optimal 2 to the k power designs are members of the class of fold-over design is offered. Optimal 2 to the k power designs were found for experiments including up to eight factors and of size such that an orthogonal array of strength three cannot be constructed. Dissert. Abstr.

N78-17783 Rochester Univ., N. Y.
DYNAMICAL PROCESS IN STATISTICAL MECHANICS Ph.D. Thesis
Masanori Ohya 1976 127 p
Avail: Univ. Microfilms Order No. 77-25472

The dynamical behavior of infinite physical systems of quantum statistical mechanics under the effect of perturbations was studied. Problems in nonequilibrium statistical mechanics were investigated, and work was performed in the exact and the linear response senses so that the domain of the validity of the linear response theory was considered. Results by two exactly solvable models are illustrated: X-Y model and Weiss Ising model. The similarity and difference between the linear response theory and the exact theory are presented in model discussions. Dissert. Abstr.

N78-17784 Iowa State Univ. of Science and Technology, Ames.
NONADDITIVITY IN RANDOMIZED BLOCK DESIGNS WITH MULTIVARIATE RESPONSES Ph.D. Thesis
Paul Alton DuBose 1977 109 p
Avail: Univ. Microfilms Order No. 77-25980

Further development of multivariate tests for nonadditivity incorporating the ideas used in univariate tests were presented. The thesis extends analysis to the multivariate case to given sufficient conditions for (a) the Wishart distributions of quadratic forms with matrix arguments and random idempotent matrices and (b) the independence of such distributions. The study investigates nonadditivity in composite variables, linear combinations of primary response variables. Scale and location invariance of all composite variable and multivariate tests are also investigated. Dissert. Abstr.

N78-17785 California Univ., Los Angeles.
PARAMETER IDENTIFICATION OF LINEAR STOCHASTIC SYSTEMS WITH TIME DELAYS Ph.D. Thesis
Edward Cheung Wong 1977 206 p
Avail: Univ. Microfilms Order No. 77-25354

A linear discrete stochastic control system model containing multiple time delays in both the system and the observation output was considered. The system was nonstationary and contained unknown time delays, plant parameters and noise covariances. The output delays and the means and covariances of the initial conditions were assumed known a priori. An algorithm was established which utilized the maximum likelihood technique to identify the unknown parameters by means of a second order gradient method. The parameter estimates were based on discrete output measurements corrupted by additive Gaussian noise, and on known deterministic normal operating input. Cases of additive white and colored measurement noises were considered. Each iteration consisted of two main steps: the state estimation and the parameter identification. Dissert. Abstr.

N78-17786 Cornell Univ., New York.
GOODNESS OF FIT TESTS FOR COMPOSITE HYPOTHESES BASED ON AN INCREASING NUMBER OF ORDER STATISTICS Ph.D. Thesis
Ray Hamilton Jakobovits 1977 163 p
Avail: Univ. Microfilms Order No. 77-29370

Sequences of tests were considered for the composite null hypothesis so that the distribution function of an observed sample was a member of a specified scale-location parameter family, where the scale and location parameters were unknown and unspecified. A test of this hypothesis proposed by L. Weiss was studied. All of the results were asymptotic, as the sample size n tends to infinitiy, and all of the test criteria which were examined were based on functions of an increasing subset of the ordered sample values. Dissert. Abstr.

N78-17787 Cornell Univ., New York.
HYPOTHESIS TESTS OF HOMOGENEITY OF MEANS VERSUS MONOTONE CONCAVE ALTERNATIVES Ph.D. Thesis
James Landis Rosenberger 1977 113 p
Avail: Univ. Microfilms Order No. 77-29384

The problem of testing equality of the means H sub o : mu (x sub 1)=...=mu (x sub k) versus the restricted alternative hypothesis H sub mc with at least one inequality strict was considered. An algorithm is given to calculate the optimum contrast for equal samples and sizes and any configuration of the treatment levels. The power of the test was calculated for several configurations of the true means at a fixed distance from the null hypothesis. The likelihood rato test x bar squared was derived for the cases with three and four means and sigma squared known. The power for both the most stringent somewhere most powerful test and the likelihood ratio tests were evaluated or simulated and the tests were compared for several configurations of treatment levels and configurations of true means. Dissert. Abstr.

N78-17788 Iowa Univ., Iowa City.
RANK TESTS BASED UPON THE MAXIMUM OF A CLASS OF RANK STATISTICS Ph.D. Thesis
Harold Eugene Sargent 1977 94 p
Avail: Univ. Microfilms Order No. 77-28510

After considering several classes of statistics, two different classes were retained and investigated at length. One consisted of rank statistics based upon step function scoring functions, while the other consisted of five modified Wilcoxon type statistics. For each class, it was shown that the test statistic has a limiting distribution which is the same as the distribution of the maximum of a certain multivariate normal vector. Certain properties of these test statistics were derived including monotonicity of the power function and consistency. The rate of convergence of the null distributions of the test statistics to the limiting distributions was also examined. In addition these two-sample procedures were generalized to a certain three-population problem. Dissert. Abstr.

N78-17789 State Univ. of New York, Brooklyn.
ANALYSIS OF TIME-DEPENDENT DATA SUBJECT TO CENSORING WITH APPLICATIONS TO CLINICAL TRIALS Ph.D. Thesis
Charles John Sommer 1977 182 p
Avail: Univ. Microfilms Order No. 77-27517

The problem of analyzing time dependent data subject to censoring was addressed, with attention to how the results apply to clinical trials. The problem was viewed in the framework of a clinical trial, involving K > or equal to 2 mutually exclusive outcomes of interest, the occurrence of any one signifying the end of the study. Two statistical models were proposed to describe the problem, and these formulations were subsequently shown to be mathematically equivalent. As a result, the inherent advantages of each representation were exploited. An estimator of the probability (p) of a time dependent event (e.g., remission of disease), which depends only on the frequencies of the uncensored events was introduced. Conditions under which this estimator was the maximum likelihood estimator of p were determined, as well as the conditional distributional properties of this estimator. Dissert. Abstr.

N78-17790 Florida Univ., Gainesville.
ON THE DISTRIBUTION OF A LINEAR COMBINATION OF t-DISTRIBUTED VARIABLES Ph.D. Thesis
Glenn Alan Walker 1977 115 p
Avail: Univ. Microfilms Order No. 77-29292

For odd degrees of freedom the characteristic function of a

Student t random variable is expressible in closed form. The characteristic function of an arbitrary linear combination of independent t-variables is then derived and the distribution function is obtained, itself expressible as a weighted sum of Student t distribution functions. An easy method of obtaining the weights was demonstrated. Dissert. Abstr.

N78-17791 Cornell Univ., Ithaca, N. Y.
ESTIMATION OF SPARSE CONTINGENCY TABLES AND OF NORMAL MIXTURES Ph.D. Thesis
Dalton Soares Arantes 1977 160 p
Avail: Univ. Microfilms Order No. 77-28182

The problem of estimation of discrete probability distributions when the only information available is a set of constraints is considered. For the no-data case the point in the constrained region that is closest in some metric to the uniform distribution is chosen for the estimate. For the case with data the suggested estimate is the one which is close to the relative frequency distribution but shrunk toward the no-data estimate as in empirical Bayes. The estimation of paramaters characterizing a family of countable mixtures of normal densities, or the estimation of the density itself, is then studied. Estimations are obtained by maximizing the likelihood function over a restricted parameter space, and by maximizing a penalized log-likelihood function over the unrestricted parameter space. A third estimation procedure for the parameters of a finite mixture of normals is given. A computer algorithm for this method, as well as for the maximum likelihood related approaches, is studied and tested with computer simulated samples. Dissert. Abstr.

N78-17792 Purdue Univ., Lafayette, Ind.
MINIMAX, ADMISSIBLE, AND GAMMA-MINIMAX MULTIPLE DECISION RULES Ph.D. Thesis
Roger Lee Berger 1977 95 p
Avail: Univ. Microfilms Order No. 77-30058

Multiple decision problems are decision theory problems in which the action space has a finite number of elements. Two different types of multiple decision problems were considered, herein. These two types of problems were subset selection problems and robustness of Bayes rules problems. Subset selection problems arise because the classical tests of homogeneity were often inadequate in practical situations where the experimenter has to make decisions regarding k(< or equal to 2) populations, treatments, or processes. This inadequacy may be alleviated by formulating the problems as multiple decision problems aimed at ranking or selection of the k populations. A formulation was proposed in which the population of interest was selected with a fixed minimum probability P asterik over the entire parameter space. This formulation was called the subset selection formulation. Dissert. Abstr.

N78-17793 Purdue Univ., Lafayette, Ind.
MINIMAX RIDGE REGRESSION ESTIMATION Ph.D. Thesis
George C. Casella 1977 163 p
Avail: Univ. Microfilms Order No. 77-30065

The development of ridge estimators, the idea of stability, some of the known error properties of ridge estimators and some results concerning Stein-type estimators, which were developed exclusively to improve squared error loss are discussed. Estimation of a multivariate normal mean is considered. Asymptotic expressions for the risk of a class of ridge estimators are developed, and sufficient conditions for tail minimaxity are derived. Necessary conditions for minimaxity are also derived. These results are used to show that for a smaller class of ridge estimators, the sufficient conditions for tail minimaxity are also sufficient conditions for minimaxity. For a subclass of these estimators, the same sufficient conditions are shown to be necessary and sufficient conditions for minimaxity. The effect on the condition number of the design matrix of forcing the ridge estimator to be minimax is examined. Results point out an incompatibility in the two concepts of minimaxity and stability. Dissert. Abstr.

N78-17794 Florida Univ., Gainesville.
A STUDY OF THE USE OF MARKOV CHAIN STATISTICAL PROCEDURES WITH CATEGORY TYPE OBSERVATION DATA Ph.D. Thesis
Margaret Anne Dudasik 1977 136 p
Avail: Univ. Microfilms Order No. 77-29240

The use of the Markov chain statistical model with category type observation data was studied. The relative goodness-of-fit of the data to the assumptions of independence, one-step dependence, and two-step dependence was investigated using Goodman and Kruskal's Tau (Tau sub b) and a chi-square test statistic. Using a chi-square test it was found that an assumption of one-step dependence or longer was preferable to an assumption of independence of data items in the chain. Various properties of Markov chains were applied to the observation data and the results interpreted in terms of classroom behavior. A transition probability matrix, an equilibrium matrix, and the mean recurrence time were constructed for each data set. Absorbing categories were created and the distribution of the passage times into the designated categories was investigated. Dissert. Abstr.

N78-17795 Arizona Univ., Tucson.
A NON-PARAMETRIC APPROACH TO SEQUENTIAL DETECTION OF SMALL CHANGES IN DISTRIBUTION Ph.D. Thesis
Dargan Frierson, Jr. 1977 143 p
Avail: Univ. Microfilms Order No. 77-29513

Suppose in a sequence of independent random variables (X sub n, n = 1,2,...) which are observed sequentially, the distribution changes from one unknown distribution to another at some unknown value of n. The problem of constructing stopping rules which stop soon after the distribution changes and have a low preassigned probability of false alarm is discussed. A stopping rule based on normalized cumulative sums is proposed and its asymptotic properties are derived. The basic properties of sequential ranks are investigated, and the weak limit is shown to be a Brownian motion. The applicability of this rule to the problem of establishing control in a production process is assessed and the asymptotic rule, is compared, with that of the limiting process arising from the usual cumulative sums of the observations. Dissert. Abstr.

N78-17796 Yale Univ., New Haven, Conn.
ASYMPTOTIC DISTRIBUTIONS OF LATENT ROOTS IN CANONICAL CORRELATION ANALYSIS AND IN DISCRIMINANT ANALYSIS WITH APPLICATIONS TO TESTING AND ESTIMATION Ph.D. Thesis
William James Glynn 1977 148 p
Avail: Univ. Microfilms Order No. 77-28031

The principal aim of this research is to derive asymptotic expansions for the distributions of latent roots which occur in canonical correlation analysis. The results are used to obtain estimates of the population roots and to study tests that some of the population roots are zero. Dissert. Abstr.

N78-17797 Iowa State Univ. of Science and Technology, Ames.
NON-HOMOGENEOUS MARKOV CHAINS AND THEIR APPLICATIONS Ph.D. Thesis
Cheng-Chi Huang 1977 131 p
Avail: Univ. Microfilms Order No. 77-29843

The rate of convergence of the product Pm+1 Pm+2...Pm+n to Q in terms of the rate of convergence of Pn to P is determined. The finiteness of the mean visit time is used in the characterization of uniform strong ergodicity for non-homogeneous Markov chains and weak ergodicity for homogeneous Markov chains. The concepts of scalar and diagonal normalization are applied to finite nonhomogeneous Markov chains with at least one absorbing state. Some practical uses of such modified chains are explored. Dissert. Abstr.

N78-17798# Pennsylvania State Univ., University Park. College of Business Administration.
NON-COOPERATIVE STOCHASTIC DOMINANCE GAMES
Peter C. Fishburn Nov. 1977 23 p refs
(Contract N00014-75-C-0857)
(AD-A047728; TR-27) Avail: NTIS HC A02/MF A01 CSCL 12/1

A non-cooperative stochastic dominance game is a non-cooperative game in which the only knowledge about the players: preferences and risk attitudes is presumed to be their preference orders on the set of n-tuples of pure strategies. Stochastic dominance equilibria are defined in terms of mixed strategies

for the players that are efficient in the stochastic dominance sense against the strategies of the other players. It is shown that the set of SD equilibria equals all Nash equilibria that can be obtained from combinations of utility functions that are consistent with the players: known preference orders. The latter part of the report looks at antagonistic stochastic dominance games in which some combination of consistent utility functions is zero-sum over the n-tuples of pure strategies. Author (GRA)

N78-17799# International Institute for Applied Systems Analysis, Laxenburg (Austria).
A MULTIVARIATE TIME SERIES APPROACH TO MODELING MACROECONOMIC SEQUENCES
Johannes Ledolter May 1977 34 p refs
(IIASA-RM-77-33) Avail: NTIS HC A03/MF A01

A multivariate generalization of autoregressive integrated moving average models is discussed. A methodology for constructing multivariate time series models was developed and the derivation of forecasts from such models considered. A bivariate model for Austrian macroeconomic sequences was constructed. Whether multivariate time series methods can be expected to lead to a significant increase in prediction accuracy for macroeconomic series is also discussed. Author (ESA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N78-17800 California Univ., Los Angeles.
SEARCH FOR MOVING TARGETS Ph.D. Thesis
Anthony Paul Ciervo 1977 83 p
Avail: Univ. Microfilms Order No. 77-23849

A problem in the theory of search involved the calculation of the probability of detection for searchers following known paths while attempting to detect a target whose motion was characterized statistically. The searcher's laws of detection and the target's initial distribution are given. The problem was solved using the transition probabilities directly, and a closed-form expression for the probability of detecting a fleeing datum with an arbitrary search density. This solution was used to perform a gradient optimization for placement of stationary searchers in an ASW context. Dissert. Abstr.

N78-17801 Stanford Univ., Calif.
THE ANALYSIS OF A PRACTICAL AND NEARLY OPTIMAL PRIORITY QUEUE Ph.D. Thesis
Mark Robbin Brown 1977 103 p
Avail: Univ. Microfilms Order No. 77-25649

New methods of representing binomial queues were given which reduce the storage overhead of the structure and increase the efficiency of operations on it. One of these representations allows any element of an unknown priority queue to be deleted in log time, using only two pointers per element of the queue. A complete analysis of the average time for insertion into and deletion from a binomial queue was performed. This analysis was based on the result that the distribution of keys in a random binomial queue is also the stationary distribution obtained after repeated insertions and deletions. Dissert. Abstr.

N78-17802 Michigan Univ., Ann Arbor.
DYNAMIC OPTIMIZATION APPLIED TO SYSTEMS WITH PERIODIC DISTURBANCES Ph.D. Thesis
Prem Krishna Gupta 1977 246 p
Avail: Univ. Microfilms Order No. 77-26255

Four problems of varying orders of difficulty were selected and solved. The objective function was an integral of a continuous function of control variables. Constraints on state and control variables were included. The method of finite differences was used to transform the dynamic optimization problem into a constrained multivariable optimization problem. An approach, called ASPE (algorithm to satisfy periodicity equalities), was used to satisfy equality constraints representing periodicity conditions. A system in which the derivatives of final states with respect to initial states remained constant, ASPE exactly satisfied the periodicity equalities at each point during the optimization process, but for a nonlinear system, it approximated the exact solution. As the optimum was approached, many small moves toward the optimum were made. Because of this characteristic ASPE gave a good approximation to the exact solution. Dissert. Abstr.

N78-17803# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
A NEW APPROACH TO ARMA MODELING
H. L. Gray, G. D. Kelley, and D. D. McIntire 1 Dec. 1977 82 p refs
(Contract N00014-75-C-0439)
(AD-A047748; TR-126) Avail: NTIS HC A05/MF A01 CSCL 12/1

In recent years the Box-Jenkins method has become a popular technique for forecasting future behavior of a time series. Once the forecast model is known the method is very easy to employ and adequate computer packages are available for most purposes. Unfortunately the problem of determining the appropriate forecast model has, for models of any complexity, been one of the major stumbling blocks to the user of this method. In this paper a satisfactory solution to that problem is obtained and it is demonstrated by numerous examples how this greatly enlarges the class of data sets which can be adequately modeled by autoregressive-moving average models. This new approach is sufficiently unequivocal so that most users will find it easy to implement. Author (GRA)

N78-17804# California Univ., Berkeley. Operations Research Center.
BOUNDS AND COMPARISONS FOR SOME QUEUEING SYSTEMS
Shun-Chen Niu Nov. 1977 68 p refs
(Contract N00014-77-C-0299; Grant AF-AFOSR-3213-77)
(AD-A047951; ORC-77-32) Avail: NTIS HC A04/MF A01 CSCL 12/1

Bounds and comparisons for various performance measures in tandem queueing systems and loss systems are studied. Using a definition of variability of random variables, it is proven that for a tandem queueing system with n stations in series, where each station can have either one server with an arbitrary service distribution or a number of constant servers in parallel, the expected total waiting time in system of every customer decreases as the variability of interarrival and service distributions decreases. A new sufficient condition for customer average delay to be smaller (larger) than time average delay in single server queues is also given. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N78-17805 George Washington Univ., Washington, D. C.
ON THE STRUCTURE OF THE TORSION SUBGROUP OF THE GROUP OF UNITS OF A GROUP RING Ph.D. Thesis
Walter Lane Stanley 1977 53 p
Avail: Univ. Microfilms Order No. 77-23830

The generators of the group of units of finite order was derived for group rings whose base ring is a field. R is an integral domain of characteristic zero and G is a finite Abelian group. A unit in RG is an element with a multiplicative inverse, and the set of all units of RG, U(RG) consists of all units in RG with finite order. Results obtained from investigation of TU(RG) are reported. Dissert. Abstr.

N78-17806 Illinois Univ., Urbana-Champaign.
EQUIVALENCE OF BOOLEAN FUNCTIONS UNDER AFFINE TRANSFORMATIONS Ph.D. Thesis
Jonell Anne Duda Comerford 1977 104 p
Avail: Univ. Microfilms Order No. 77-26653

An algorithm is devised which determines, given two Boolean functions, the set of affine transformations making them equivalent. Two functions are affinely equivalent if one can be produced by permuting and/or complementing the input variables of the other function and adding modulo two to the resultant function a set of complemented or uncomplemented input variables. Functions which are equivalent in this sense can be realized by virtually

the same physical networks. The algorithm given can easily be carried out by hand for functions with less than six input variables. The methods of this thesis provide a means of calculating the fixed group of a function. A procedure is also given for determining whether a function, represented in disjunctive normal form, is a modulo two sum of variables. Dissert. Abstr.

N78-17807 Minnesota Univ., Minneapolis.
SELF-REFLEXIVE BANACH SPACES Ph.D. Thesis
Linda Marie Barnes Davis 1977 157 p
Avail: Univ. Microfilms Order No. 77-26087

The Banach space is defined with the conjugate symmetric sesquilinear form (.,.). The range spaces of both bounded and unbounded orthogonal projects are characterized. The structure of self-reflexive Banach spaces are probed including: a study of subspaces where the inner product vanishes: an investigation of self-reflexive Banach space with underlying topology that of Hilbert space; and an inquiry into orthogonal sums of subspaces. Representations of a set with an involution are studied by unitary operators on a self-reflexive Banach space. An operator A is defined to be self-adjoint if $A=A^*$. Proof is given that if A is a bounded self-adjoint operator with a real spectrum such that the Gelfand transform of the algebra generated by A and the identity operators are bijective, then A has a spectral decomposition. Dissert. Abstr.

N78-17808 Nebraska Univ., Lincoln.
THE STRUCTURE OF REGULAR AND INVERSE SEMIGROUPS Ph.D. Thesis
Karl Erland Byleen 1977 191 p
Avail: Univ. Microfilms Order No. 77-29487

Three essentially different theories have appeared in the 1970's to describe the structure of regular or inverse semigroups: the Munn-Grillet theory via fundamental inverse or regular semigroups, McAlister's P-theory for inverse semigroups, and the structure mapping approach of Meakin and Nambooripad. Each approach is used as a tool in describing the structure of various semigroups, placing primary emphasis on the structure mapping approach. Dissert. Abstr.

N78-17809 Colorado Univ., Boulder.
A DESCRIPTION OF THE TOPOLOGY ON THE DUAL SPACE OF A NILPOTENT LIE GROUP Ph.D. Thesis
Kenneth Irwin Joy 1977 96 p
Avail: Univ. Microfilms Order No. 77-29935

Let G be a real connected simply connected nilpotent Lie group. The set rafter G consisting of all equivalence classes of irreducible unitary representations of G was analyzed The elements of rafter G are described in terms of representations induced from a subgroup of dimension less than the dimension of G. Convergence on rafter G was reduced to the study of convergence of sequences of subgroup representation pairs in two ways: (1) pairs (H,T) where (T belongs to rafter H and H is a subgroup of codimension one in G and (2) pairs K, sub X where K is a subgroup of G of dimension less than the dimension of G and sub X was a character of K. Dissert. Abstr.

N78-17810 Tennessee Univ., Knoxville.
TOTAL SEQUENCES IN TOPOLOGICAL VECTOR SPACES Ph.D. Thesis
John David Nichols 1977 103 p
Avail: Univ. Microfilms Order No. 77-27683

The extension to more general topological vector spaces of two results concerning sequences of functions in L squared [0,1] is presented. The first result was extended by showing that in a Frechet space or a complete p-normed space there was a scalar operator which converted a given sequence into a total sequence provided that there existed a nested, equicontinuous family of commuting projections which had the additional properties that the union of the ranges of these projections was dense and that each projected sequence was total in each projected space. Secondly, it is shown that in certain function metric spaces a total sequence had any finite subset and certain infinite subsets deleted without destroying totality. Dissert. Abstr.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N78-17811# Catholic Univ. of America, Washington, D. C.
A DISCRETE LINE DOMAIN APPROACH TO FREQUENCY TRACKING OF UNSTABLE SIGNALS Ph.D. Thesis
Liona Russell Roberts, Jr. 1977 169 p
Avail: Univ. Microfilms Order No. 77-26594

An automated frequency tracker of signals was considered. The signals and noise may be analytically represented by a two dimensional discrete physical spectrum. The defined discrete line tracker (DLT) tracks a time varying peak in frequency in a convenient representation called the line domain. The DLT was theoretically shown to be a nonlinear device which is adaptive to the signal to noise ratios in a stable and beneficial way. Analysis of the linearized system predicts several average characteristics. Experiments with the DLT against a hierarchy of signals illustrate its performance capability. With a unique interpolation algorithm, the DLT approaches close to theoretical bounds in the measurement of the frequency of tones.
Dissert. Abstr.

N78-17812# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON EASTERN EUROPE: SCIENTIFIC AFFAIRS, NO. 571
3 Feb. 1978 31 p Transl. into ENGLISH from Selected Foreign Periodicals (Hungary)
(JPRS-70590) Avail: NTIS HC A03/MF A01

Topics discussed include: Bulgarian studies of genetic structure and radiation effects; hybrid integrated circuit technology in Hungary; and cancer diagnosis, acupuncture, voice restoration, and the use of metal scaffolds and casings for prefabricated structures in Romania. A.R.H.

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N78-17813 Catholic Univ. of America, Washington, D. C.
ACOUSTIC HIGH FREQUENCY SCATTERING BY ELASTIC CYLINDERS Ph.D. Thesis
Joseph Waldo Dickey 1977 141 p
Avail: Univ. Microfilms Order No. 77-26588

Acoustic scattering from an infinite elastic cylinder in a fluid is explained in terms of creeping and through waves. The theory is developed by applying the Sommerfeld-Watson transformation to the normal mode solution. Dispersion and attenuation curves for the dominant surface wave modes are presented and scattering cross sections are given for all modes. Some critical features of the asymptotic behavior of the cylinder functions are reviewed and the computer programs used to obtain the numerical results are described and presented. The magnitude of several modes contribution to the scattered field is presented as a function of frequency showing how the surface wave modes account for the normal mode resonances at low incident wave number times cylinder radius (ka), and become the dominant mechanism at high ka. Dissert. Abstr.

N78-17814 Georgetown Univ., Washington, D.C.
ULTRASONIC REFLECTION FROM A THREE-LAYER SYSTEM Ph.D. Thesis
Peter Hsien Huang 1977 109 p
Avail: Univ. Microfilms Order No. 77-26392

Leaky plate waves and their mode structure in a water/ice/air system were investigated. Using the two dimensional optimization method a model was developed in terms of particle displacement associated with plane periodic waves propagating in layered media, and used to construct a computer program which minimizes the sum of absolute values of the real part and the imaginary part of the dispersion relation for a water/ice/air

system. The group velocity dispersion characteristics were separately computed for different elastic constants of a brass plate. Numerical results and experimental investigations established that elastic parameters may be used as a measure of propagation characteristics of elastic waves in a layered structure. Conversely, elastic wave propagation characteristics may be used as a measure of elastic parameters of a layered structure.
Dissert. Abstr.

N78-17815 Iowa Univ., Iowa City.
BINAURAL CRITICAL MASKING BANDS Ph.D. Thesis
Joseph Charles Sever, Jr. 1977 148 p
Avail: Univ. Microfilms Order No. 77-28512

Current understanding of the relation between monaural estimates of the critical bandwidth for masking and those obtained in binaural listening situations is poor. The study was designed to improve this situation by obtaining estimates of critical bandwidth when the signal and masker were presented: (1) monaurally (NmSm), (2) binaurally with both signal and masker in phase at the ears (NoSo), (3) binaurally with masker in phase and signals 180 deg out of phase (NoSo pi). Threshold estimates were obtained in a two interval forced-choice paradigm (21FC) as a function of masker bandwidth for signal frequencies of 500 and 2000 Hz for the three conditions mentioned above. For both methods, critical bandwidth was defined as the bandwidth associated with a threshold value that was 3 db less than the asymptotic value of the function. For both signal frequencies, the derived critical bandwidth estimates for the NmSm and NoSo conditions were similar and were 60 to 70% of the critical bandwidth estimates obtained in the NoS pi condition.
Dissert. Abstr.

N78-17816 Miami Univ., Coral Gables, Fla.
HIGH PRESSURE SOUND SPEEDS AND PVT PROPERTIES OF PURE WATER, SEAWATER, AND MAJOR SEA SALTS Ph.D. Thesis
Chen-Tung Arthur Chen 1977 173 p
Avail: Univ. Microfilms Order No. 77-28932

Pure water sound speed data were reanalyzed and a sound speed equation was determined. An equation of state for pure water was determined from the new pure water sound speed equation. A high pressure seawater sound speed equation was used to determine a precise equation of state for seawater valid over the range of 0 to 4 percent infinity S, 0 to 40 C, and 0 to 1000 bars. One atmosphere densities and high pressure sound speeds for the aqueous solutions of NaCl, MgC12, Na2SO4, and MgSO4 were measured and presented in easy-to-use equations. The additivity principle was investigated and it is concluded that Young's volume mixing rule is valid at elevated pressures at various salinities and temperatures for seawater. The use and misuse of the pure water equation of state for lake waters and the importance of the dissolved substances on the thermodynamic properties of lake waters were discussed. A short equation of state valid over the limnological range of salinity, temperature, and pressure is given. Dissert. Abstr.

N78-17817 Catholic Univ. of America, Washington, D. C.
SCATTERING FROM RANDOMLY ROUGH SURFACES (SOME NUMERICAL EXPERIMENTS) Ph.D. Thesis
Edward George Liszka 1977 159 p
Avail: Univ. Microfilms Order No. 77-27717

The limits of the Kirchhoff method are considered and a systematic solution algorithm for correcting the Kirchhoff approximation is developed by incorporating factors accounting for multiple scatter, shadowing, and surface curvature. The solution algorithm is applied to the problem of predicting acoustic scattering by a surface whose random character simulates the airwater interface of the ocean. A numerical Monte Carlo procedure is devised for applying the corrected Kirchhoff approximation to an investigation of the scattered field statistics for an ensemble of computer generated surfaces. The situation of an acoustic plane wave incident on a simulated ocean surface is considered. The validity of the procedure is confirmed by comparing the outputs for an assumed uncorrected Kirchhoff approximation with theoretically derived predictions for Gaussian random surfaces.
Dissert. Abstr.

N78-17818 North Carolina State Univ., Raleigh.
THE ACOUSTIC RADIATION FROM A ROTATING, RESONATING DISK Ph.D. Thesis
David Meeker OBrien 1977 176 p
Avail: Univ. Microfilms Order No. 77-29630

One of the most isidious noise problems in the woodworking industry is that noise produced by a circular saw blade that is resonating in one of its normal modes. A model is developed for the acoustic radiation from a rotating, resonating disk in an effort to describe the mechanism of this intense noise production. The model first predicts the natural frequencies and mode shapes for a specified number of nodal diameters of an annular disk clamped at the center. These are found by the application of a finite difference technique to the biharmonic plate equation. Experiment has shown that this model can predict the natural frequencies to within 1.5% of the measured value. A procedure was also developed that identifies the nodal configurations of the resonating, rotating disk. This procedure showed that the only modes that were excited during rotation contained many nodal diameters but no nodal circles. Dissert. Abstr.

N78-17819 Georgia Inst. of Tech., Atlanta.
AN EXPERIMENTAL STUDY OF THE SEPARATION OF COMBUSTION AND ENTROPY NOISE Ph.D. Thesis
Mangapathy Muthukrishnan 1977 114 p
Avail: Univ. Microfilms Order No. 77-2921

Acoustic experiments were conducted on a combustor taken from a Boeing 502-7D gas turbine unit. Measurements consisted of combustor interior pressure fluctuations, exterior radiated sound pressures and burner exit plane mean as well as fluctuating temperature. Analysis techniques included spectra, cross correlation and ordinary as well as partial coherence estimates of the measurements. The results indicated that hydrodynamic noise, which was nonpropagational pseudosound, dominated combustion generated noise in the interior of the combustor below 150 Hz. The most important conclusion was that at low exit Mach numbers, the core engine noise was mostly attributable to combustion noise whereas at high Mach numbers, entropy noise overtook and dominated combustion noise. Dissert. Abstr.

N78-17820 North Carolina State Univ., Raleigh.
OPTICAL PROPERTIES OF PLANO-CONVEX CYLINDRICAL LENS ARRAYS Ph.D. Thesis
Robert Foisy Adrion 1977 187 p
Avail: Univ. Microfilms Order No. 77-29661

Optical properties of cylindrical lens arrays are examined for application to lenticular, or lens-like, rear-projection screens. Methodology for study of far-field diffraction patterns of cylindrical lens arrays is presented, following the natural factorization of the diffraction pattern into an element factor, which depends on individual lens properties but not on array geometry, and an array factor, which depends on array geometry but not on individual lens details. Geometrical optics and physical optics treatments of elements factors are given for any lenticule having a smooth, convex shape. Element factor measurements are included and reconciled with geometrical and physical predictions. Methods of synthesis of lenticule shapes to meet prescribed element factors are included as well as procedures for fabricating arrays of contiguous cylindrical lenses. Dissert. Abstr.

N78-17821*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PSEUDO CONTINUOUS WAVE ACOUSTIC INSTRUMENT Patent Application
Joseph S. Heyman, inventor (to NASA) Filed 8 Dec. 1977 12 p
(NASA-Case-LAR-12260-1; US-Patent-Appl-SN-858763) Avail: NTIS HC A02/MF A01 CSCL 20F

A device for measuring acoustic properties and their changes in a sample of liquid, gas, plasma or solid is described. A variable frequency source is applied to the sample by means of a transducer to produce sound waves within the sample. The application of the variable frequency source to the sample is periodically interrupted for a short duration. Means are connected to the transducer for receiving the resulting acoustic signals during the interruptions for producing a control signal indicative of a difference in the frequency of the output of the variable frequency source and the frequency of a mechanical resonant peak in the sample.

The control signal is applied to the variable frequency source to maintain its output frequency at the frequency of the mechanical resonant peak. The change in frequency of the variable frequency source is indicative of the shift in frequency of the mechanical resonant peak and the amplitude of the acoustic signals is indicative of the attenuation of the acoustic signals in the sample. NASA

N78-17822*# Hersh Acoustical Engineering, Chatsworth, Calif.
EFFECTS OF GRAZING FLOW ON THE STEADY-STATE FLOW RESISTANCE AND ACOUSTIC IMPEDANCE OF THIN POROUS-FACED LINERS Final Report
A. S. Hersh and B. Walker Washington NASA Jan. 1978 80 p refs
(Contract NAS1-14310)
(NASA-CR-2951) Avail: NTIS HC A05/MF A01 CSCL 20A

The effects of grazing flow on the steady state flow resistance and acoustic impedance of seven Feltmetal and three Rigimesh thin porous faced liners were studied. The steady-state flow resistance of the ten specimens was measured using standard fluid mechanical experimental techniques. The acoustic impedance was measured using the two microphone method. The principal findings of the study are that the effects of grazing flow were measured and found to be small; small differences were measured between steady-state and acoustic resistance, and a semi-empirical model was derived that correlated the steady-state resistance data of the seven Feltmetal liners and the face sheet reactance of both the Feltmetal and Rigimesh liners. Author

N78-17823*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PREDICTION OF GROUND EFFECTS ON AIRCRAFT NOISE
S. Paul Pao, Alan R. Wenzel, and Paul B. Oncley (MAN-Acoustics and Noise, Inc.) Jan. 1978 42 p refs
(NASA-TP-1104; L-11833) Avail: NTIS HC A03/MF A01 CSCL 20A

A unified method is recommended for predicting ground effects on noise. This method may be used in flyover noise predictions and in correcting static test-stand data to free-field conditions. The recommendation is based on a review of recent progress in the theory of ground effects and of the experimental evidence which supports this theory. It is shown that a surface wave must be included sometimes in the prediction method. Prediction equations are collected conveniently in a single section of the paper. Methods of measuring ground impedance and the resulting ground-impedance data are also reviewed because the recommended method is based on a locally reactive impedance boundary model. Current practice of estimating ground effects are reviewed and consideration is given to practical problems in applying the recommended method. These problems include finite frequency-band filters, finite source dimension, wind and temperature gradients, and signal incoherence. Author

N78-17824# Stanford Research Inst., Menlo Park, Calif.
SCATTERING OF SOUND BY INTERNAL WAVES: THE ROLE OF PARTICLE VELOCITIES
W. H. Munk and F. Zachariasen Nov. 1977 39 p
(Contract DAHC15-73-C-0370)
(AD-A047683; SRI-JSR-77-21) Avail: NTIS HC A03/MF A01 CSCL 20/1

Internal waves scatter sound by two related perturbations: (1) those associated with vertical particle displacements zeta (x, y, z, t) in the presence of a vertical gradient of (potential) sound speed: delta times c = zeta times gamma sub z c sub p; (2) those associated with horizontal particle velocities u(x, y, z, t). The combined perturbations in refractive index are delta times c/c - u/c. The second term, which has been generally neglected, does become important under two rather special circumstances: (1) in sound transmission along a deep downward loop, and (2) in the difference between transmission from a source at point A to a receiver at point B and transmission from a source at B to a receiver at A. Author (GRA)

N78-17825# Rhode Island Univ., Kingston. Narragansett Marine Lab.
R/V TRIDENT CRUISE SUMMARIES CY 1962 THROUGH CY 1971
Eugene B. Silverman and James H. Howard, Jr. Nov. 1977 250 p
(Contract N00014-75-C-0308)
(AD-A047655; TR-77-3-ONR) Avail: NTIS HC A11/MF A01 CSCL 13/10

Three experiments investigated the effect of an interfering white noise on the recognition of brief-duration complex sounds. Listeners were presented with a 20 msec signal followed, after a variable delay, by a 500 msec white noise burst. Their task was to classify the signal into one of two categories on the basis of either its fundamental frequency, waveform or formant frequency. The main focus of the experiments was to investigate the relation between performance and the auditory features or cues present in the signal. Recognition performance improved with increasing inter-stimulus intervals up to an asymptote at approximately 200 msec. This finding is consistent with earlier results in suggesting that brief-duration signals are retained for a short time in a precategorical sensory memory for further processing. In addition, the data revealed that asymptotic performance level was determined primarily by the distinctiveness or discriminability of the relevant auditory feature and by the amount of listener experience with the relevant feature. It was concluded that practiced listeners have an improved ability to selectively focus their attention on specific auditory cues in a complex aural display. Author (GRA)

N78-17826# Army Electronics Command, Fort Monmouth, N. J.
A PRELIMINARY ANALYSIS OF TWO SOUND RANGING ALGORITHMS
W. Miller and B. Engebos Jul. 1977 45 p refs
(AD-A047432; ECOM-5826) Avail: NTIS HC A03/MF A01 CSCL 17/1

Two sound ranging algorithms are examined by observing their behavior in a basic controlled environment. The consistency of both is verified under a variety of meteorological regimes and a selection of arrival time accuracies. The advantages and shortcomings of each are discussed. In particular, possible compromise between timing accuracy and integrity of meteorological data is evidenced. Field applicability may prove feasible. Author (GRA)

N78-17827# Naval Research Lab., Washington, D. C. Applied Ocean Acoustics Branch.
HORIZONTAL RAY CURVATURE EFFECTS IN BASINS, TROUGHS, AND NEAR SEAMOUNTS BY USE OF RAY INVARIANTS Interim Report
C. H. Harrison (Admiralty Res. Lab.) 30 Sep. 1977 25 p refs
(ZF5255201)
(AD-A047415; AD-E000035; NRL-8144) Avail: NTIS HC A02/MF A01 CSCL 20/1

Horizontal curvature of long-range underwater sound rays can be caused by repeated reflection from a sloping or undulating seabed. Ray invariants were used to derive analytical solutions for the horizontal projections of ray paths for many types of basins, troughs, and ridges. In an arbitrary basin (of low bottom slope) containing isovelocity water, the elevation angle of the ray depends only on the ratio of the basin depth at source and receiver and on the initial ray angle. In a basin with rotational symmetry or a trough with constant cross section, the heading of the ray may be determined anywhere from the initial heading, the final heading, and the elevation angle. Rough figures are derived for the geometrical spreading loss and reflection loss at the edge of a basin. Author (GRA)

N78-17828# Naval Research Lab., Washington, D. C. Underwater Sound Reference Div.
COMPLEX CEPSTRUM PROCESSING OF DIGITIZED TRANSIENT CALIBRATION DATA FOR REMOVAL OF ECHOES Interim Report
Lynn B. Poche, Jr. 30 Sep. 1977 30 p refs
(XF11121200)
(AD-A047414; AD-E000043; NRL-8143) Avail: NTIS HC A03/MF A01 CSCL 09/3

The complex cepstrum technique was investigated for possible use in removing echoes caused by early reflections when low-frequency, peaked-response transducers are calibrated with

transient signals. The calibration environment permits a high signal-to-noise ratio and a free choice of input waveforms, both of which are advantages in complex cepstrum processing. The proper method of computation with this technique is discussed in detail. Cepstrum filtering methods are discussed. Synthetic measurement data produced by a J9 projector driven with a damped sinusoidal pulse and a pressure-release reflection are shown, and real measurement data from a low-frequency line array driven by a single-cycle sinusoid with complex surface and bottom reflections are also shown. In both the synthetic and the real data, the echoes were successfully removed using the complex cepstrum technique. Data were digitized directly and stored on digital magnetic tape. Oversampling was reduced by sifting to achieve the correct sampling rate required by the complex cepstrum method. The results indicate that echo removal performed by complex cepstrum processing can be accurate enough to have potential usefulness in calibration procedures.
Author (GRA)

N78-17829# Army Materials and Mechanics Research Center, Watertown, Mass.
A SURVEY OF ADVANCED TECHNIQUES FOR ACOUSTIC IMAGING Final Report
James M. Smith Aug. 1977 42 p refs
(AD-A048039; AMMRC-MS-77-7) Avail: NTIS HC A03/MF A01 CSCL 20/1

This document is a state-of-the-art survey of advanced acoustic imaging techniques developed for nondestructive testing and medical applications. Several techniques are evaluated: simple mechanical scanning systems, array imaging, acoustic holography, synthetic aperture, Bragg imaging, and ray tracing. Examples of practical imaging systems that employ these techniques are described and compared, and in order to put these systems into proper chronological perspective, an appendix is included that briefly discusses older acoustic imaging techniques.
Author (GRA)

N78-17830# Naval Research Lab., Washington, D. C.
SOME EFFECTS OF NOISE UPON MAXIMUM ENTROPY SPECTRAL ANALYSIS Interim Report
William R. King Nov. 1977 8 p refs
(RR0210541)
(AD-A047821; AD-E000065; NRL-MR-3645) Avail: NTIS HC A02/MF A01 CSCL 09/4

Some parameters of the Maximum Entropy Spectral Analysis (MESA) technique are defined for the case of an input signal added to noise. Also an optimal MESA filter is defined for determining the particular MESA power spectrum having the maximum output signal-to-noise ratio. Author (GRA)

N78-17831# Technical Research Centre of Finland, Espoo. Electronics Lab.
POSSIBLE METHODS FOR THE MEASUREMENT OF TRANSIENT INTERMODULATION DISTORTION
Matti Otala and Eero Leinonen 1976 17 p refs
(VTT-ENT-16; ISBN-951-38-0395-3) Avail: NTIS HC A02/MF A01

Conventional distortion measurements do not always correlate with the audible quality of audio amplifiers. One possible reason for this is the transient intermodulation distortion, which is unpleasantly audible but lacks a commonly known easily performable measurement method. Three new measurement methods are presented. They are the overshoot clipping method, the square-wave intermodulation method, and the pseudo-random noise intermodulation method. Relative merits, and drawbacks of the methods are discussed. Author (ESA)

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N78-17832 Catholic Univ. of America, Washington, D. C.
ELECTRON TRANSFER AND EXCITATION TRANSFER PHENOMENA IN TRANSITION METAL COMPLEXES AND MOLECULAR AGGREGATES. STUDIES BY EXCITON AND MOLECULAR ORBITAL THEORY Ph.D. Thesis
Jorge Ricardo Letelier 1977 151 p
Avail: Univ. Microfilms Order No. 77-26590

Electron transfer in a molecular aggregate assumed to be composed if identical molecules and an excess electron was investigated. The Schrodinger equation for the system is solved using as variational wavefunctions linear combinations of electron-localized states. The eigenvalues are obtained as functions of the electronic and vibrational energies of the neutral and ionic states of the individual molecules and also as functions of the intermolecular electronic interactions. Dissert. Abstr.

N78-17833 Illinois Univ., Urbana-Champaign.
PHYSICS, MOLECULAR: THEORY OF INELASTIC ATOMIC AND MOLECULAR COLLISIONS Ph.D. Thesis
Vasil Krum Babamov 1977 117 p
Avail: Univ. Microfilms Order No. 77-26627

A practical and rigorous method for treating inelastic atomic and molecular collisions is devised, taking advantage of the near classical character of the heavy particle motion. The treatment is formulated as a method for solving a set of coupled ordinary differential equations in the adiabatic representation. It is the only practical representation in which an electronically inelastic atomic or molecular collision has been rigorously formulated. The effective coupling region and the number of effectively coupled equations are known to be smaller in the adiabatic representation than in any alternative one. The disadvantages of the adiabatic representation discussed in the literature are the apparent lack of symmetry in the equations and the existence of explicit operator coupling. Dissert. Abstr.

N78-17834 Rochester Univ., N. Y.
THEORY OF DEPOLARIZATION OF FLUORESCENCE IN MOLECULAR AGGREGATES Ph.D. Thesis
Talat Shannaz Rahman 1977 201 p
Avail: Univ. Microfilms Order No. 77-25478

The depolarization of fluorescence, as a result of energy transfer between molecules, was studied for a model system of two weakly-coupled molecules. By fully including the radiative decay terms and by replacing the simple rate equation by the Stochastic Liouville Equation, a representation-independent expression for the polarization of fluorescence is obtained. The excitation spectrum of the degree of polarization of fluorescence (p) depends on the rate of intermolecular transfer of energy, the rate of transfer between the symmetry adapted states of the system and the relative orientation of the dipoles. The frequency, bandwidth and direction of polarization of the incident photon determines the initially excited states of the system.
Dissert. Abstr.

N78-17835 Oregon State Univ., Corvallis.
THEORETICAL AND EXPERIMENTAL FACTORS AFFECTING THE ACCURACY AND PRECISION OF ATOMIC ABSORPTION MEASUREMENTS Ph.D. Thesis
Nathan Wayne Bower 1977 198 p
Avail: Univ. Microfilms Order No. 77-29408

A procedure for evaluating the precision of atomic absorption measurements is presented and applied to 21 elements under varying instrumental conditions. The experimental relative standard deviations (RSD's) in absorbance obtained from repetitive measurements made with a high resolution voltmeter and on-line computer, are compared to those predicted by a recently proposed theoretical equation. Good agreement between theory and experiment is obtained which indicates the usefulness of the theoretical equation and evaluation procedure. The study reveals that, under the conditions used for atomic absorption measurements for the 21 elements, the noise associated with the lamp (i.e., signal shot noise and source flicker noise) and with the flame (i.e., flame transmission flicker noise) limit the precision at small absorbances. Flame transmission flicker noise generally increases with the flame absorbance. Dissert. Abstr.

N78-17836 Oregon State Univ., Corvallis.
SATELLITE STRUCTURE IN THE GAS PHASE X-RAY PHOTOELECTRON SPECTRA OF PLANAR UNSATURATED MOLECULES Ph.D. Thesis
Scott Alexander Chambers 1977 115 p

Avail: Univ. Microfilms Order No. 77-29410

The satellite structure present in the X-ray photoelectron spec- of three five-membered heterocyclic molecules, ethylene and two of its fluorinated analogs, and benzene with three of its fluorinated analogs are discussed. Core ionization potentials were measured for the heterocyclic molecules. Theoretical predictions of the relative intensities and energies of the satellites were made within the sudden approximation using CNDO/2 wave functions. The wave functions were then used to study charge rearrangement accompanying core ionization. Dissert. Abstr.

N78-17837 Florida Univ., Gainesville.
THE VELOCITY DEPENDENCE OF THE ABSOLUTE TOTAL IONIZATION CROSS SECTION FOR COLLISIONS OF ARGON ATOMS WITH SINGLET AND TRIPLET METASTABLE HELIUM ATOMS Ph.D. Thesis
Michael Read Woodard 1977 120 p
Avail: Univ. Microfilms Order No. 77-29297

The velocity dependence of the absolute total ionization cross section of argon atoms upon impact with selected metastable states of helium atoms was measured using a low voltage D. C. discharge as the source of the excited atoms, and a rotating slotted disk selector for velocity selection of the excited atoms. Selection of the electronic spin state of the excited atoms was accomplished by irradiation of the excited atoms with radiation from a helium discharge lamp. The ionization measurements were of sufficient precision to allow simultaneous determination of the cross section and the second electron ejection efficiency for each metastable state of helium. The secondary electron ejection efficiency of triplet metastable helium atoms on an electroplated gold surface was determined to be 0.440 + or - 0.018 in the presence of argon gas. The secondary electron ejection efficiency of singlet metastable atoms was determined to be 0.582 + or - 0.024 under similar conditions. Dissert. Abstr.

N78-17838 Yale Univ., New Haven, Conn.
THE X-RAY SPECTROSCOPY OF ELECTRONIC QUASIMOLECULES Ph.D. Thesis
Paul John Vincent 1977 184 p
Avail: Univ. Microfilms Order No. 77-28171

Angular dependences and differential production cross sections for characteristic K X-ray and non-characteristic continuum X-ray radiation from Ni + Ni, Ni + Nb, Ge + Ge, and Nb + Nb collisions were measured. The measurements show that noncharacteristic high energy X-ray emissions associated with the decay of vacant inner orbitals of a transient molecular projectile-target system formed during the collision are produced. Production mechanisms for these quasimolecular emissions are studied and the possibility of using these X-rays to extract information on the energy level structure of the quasimolecule is investigated. Dissert. Abstr.

N78-17839 Purdue Univ., Lafayette, Ind.
THE FIRST SPECTRUM OF YTTRIUM AND AN AUTOMATIC COMPARATOR FOR ITS MEASUREMENT Ph.D. Thesis
Byron Allen Palmer 1977 247 p
Avail: Univ. Microfilms Order No. 77-30119

The accuracy of the level values for neutral yttrium was significantly improved based on the new wavelength measurements, as was the accuracy of the level values of singly ionized yttrium. An automatic comparator was designed for the rapid and accurate wavelength measurements from spectrograms. The automatic comparator was capable of measuring spectral line positions on a photographic plate to better than one micron. A method which used two slits was developed and which allowed the line positions to be measured twice and then averaged, also made possible the separation of the spectral lines of the standard wavelengths from those of the unknown source. Two separate line finding techniques were used; a smoothed derivative method was used for most lines and a second method was employed on the more troublesome lines where the derivative method was unsatisfactory. Dissert. Abstr.

N78-17840 Colorado Univ., Boulder.
PICOSECOND PHOTODYNAMICS IN CONDENSED PHASE MOLECULAR SYSTEMS Ph.D. Thesis
Gregory Lee Olson 1977 307 p
Avail: Univ. Microfilms Order No. 77-29959

Ultrafast photophysical and photochemical changes produced by picosecond pulse excitation of absorbing and amplifying molecular systems are presented and discussed. Specific areas of study include: (1) fast kinetics and radiative deactivation of saturable absorbing molecules; (2) rapid modifications of electronic state populations and applications to the simultaneous gating and amplification of ultrafast optical signals; (3) radiationless processes and the assimilation of energy in triphenylmethane acid-base indicators; and (4) picosecond photodynamics and charge carrier relaxation in amorphous semiconductors. Techniques of picosecond spectroscopy are utilized and provided a time and wavelength resolved record of the ultrafast processes which occur in an optically excited medium. These techniques and specific experimental configurations required to perform these studies are outlined in detail. Dissert. Abstr.

N78-17841 Wisconsin Univ., Madison.
INCLUSIVE PHOTOPRODUCTION OF PROTONS, KAONS, AND PIONS AT SLAC ENERGIES Ph.D. Thesis
David Earl Wiser 1977 231 p
Avail: Univ. Microfilms Order No. 77-19743

The measurements were done using a bremsstrahlung photon beam. Most of the data were taken with a hydrogen target, but some deuterium data were also taken. The hydrogen data is presented in both integral and bremsstrahlung subtracted form, while the deuterium data is given only in integral form. A fit was done on the hydrogen target integral data. These results have been studied in terms of the predictions of dimensional counting theories. The data is found to be quite well described with a function involving powers of PT and (1-XR). The correspondence principle of Bjorken and Kogut is applied to this data. The energy dependence of the inclusive data, when extrapolated to the exclusive limit, is found to be similar, though somewhat steeper than that measured in exclusive photoproduction. Dissert. Abstr.

N78-17842 Utah Univ., Salt Lake City.
NUCLEAR MAGNETIC RESONANCE STUDY OF DIFFUSION OF BOUND AND FREE FLUORINE INTERSTITIALS IN ALKALINE EARTH FLUORIDES DOPED WITH TRIVALENT IMPURITIES Ph.D. Thesis
Sherman Hsiung-Neng Wei 1977 121 p
Avail: Univ. Microfilms Order No. 77-29590

Motions of both free and locally bound fluorine interstitials in the extrinsic region depend strongly on the host crystal lattice constant and the impurity dopant size. The motion of fluorine interstitials which is at the nearest neighbor site to the trivalent impurity dominates the relaxation above room temperature in CaF2:Y(3+) but is unobserved in BaF2:Y(3+). A more remotely bound fluorine interstitial motion, possibly at the next nearest neighbor site, is barely observable in CaF2:Y(3+) but becomes dominant in BaF2:Y(3+). The behavior in SrB2:Y(3+) is intermediate between that of the calcium and barium compounds. A partial dissociation of next nearest neighbor fluorine interstitial is observed in CaF2:Y(3+) above 150 C and in SrF2:Y(3+) above 54 C. Clustering effects of local dipoles also appear for the more heavily doped samples. Activation energies for all fluorine motions were measured. Dissert. Abstr.

N78-17843 North Texas State Univ., Denton.
MEASUREMENT OF THE RATE COEFFICIENTS FOR THE BIMOLECULAR AND TERMOLECULAR CHARGE TRANSFER REACTIONS OF He2(+) WITH Ne, Ar, N2, CO, CO2, AND CH4 Ph.D. Thesis
Francis Wha-Pyo Lee 1977 122 p
Avail: Univ. Microfilms Order No. 77-19674

The rate coefficients are measured for termolecular charge transfer reactions of He2 in atmospheric pressure afterglows with the minority reacting species. The concept of the rate coefficients for the bimolecular and termolecular charge transfer reactions of He2 with the secondary reacting species, theory of charge transfer process, and the reaction processes affecting the He2 population in a pure helium plasma was reviewed in detail. The equipment and the experimental techniques were described. In particular the measurements of termolecular charge transfer reactions into non-associative product channels were described. Of particular interest was the discovery that the presence of a third body can change an improbable charge transfer reaction

involving He2 into a very probable one. The size of these termolecular rates not only served to explain specific anomalous efficiencies of the charge transfer process observed in atmospheric pressure lasers but also suggested the general importance of three-body ion-molecule reactions in higher pressure plasmas.
Dissert. Abstr.

N78-17844*# Oregon Univ., Eugene. Dept. of Physics.
ATOMIC ELECTRON CORRELATION IN NUCLEAR ELECTRON CAPTURE
Mau Hsiung Chen and Bernd Crasemann [1978] 10 p refs
(Grants NGR-38-003-036; DAAG29-78-G-0010)
(NASA-CR-155922) Avail: NTIS HC A02/MF A01 CSCL 20H

The effect of electron-electron Coulomb correlation on orbital electron capture by the nucleus was treated by the multiconfigurational Hartree-Fock approach. The theoretical Be-7 L/K capture ratio was found to be 0.086, and the Ar-37 M/L ratio, 0.102. Both ratios were smaller than the independent particle predictions. Measurements exist for the Ar M/L ratio, and agreement between theory and experiment was excellent. Author

N78-17845# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
QUENCHING OF VIBRATIONALLY EXCITED N2 BY SO2 Interim Report
Milo E. Whitson, Jr. and Robert J. McNeal 9 Nov. 1977 12 p refs
(Contract F04701-77-C-0078)
(AD-A047679; TR-0078(3970-10)-3; SAMSO-TR-77-211) Avail: NTIS HC A02/MF A01 CSCL 20/8

A photoionization detection technique has been used to measure the rate of quenching of vibrationally excited N2 by SO2. The quenching rate coefficient was determined to be (6 + or - 2.3) times 10 to the -16th power cu.cm./molecule/sec.
Author (GRA)

N78-17846# National Bureau of Standards, Washington, D. C. Electronic Technology Div.
SOME ASPECTS OF USING A SCANNING ELECTRON MICROSCOPE FOR TOTAL DOSE TESTING Final Report
K. F. Galloway and P. Roitman Sep. 1977 42 p refs
(Contract DNA-IACRO-77-809)
(AD-A047425; NBSIR-77-1235) Avail: NTIS HC A03/MF A01 CSCL 18/8

This report addresses a number of aspects involved in using a Scanning Electron Microscope (SEM) for radiation testing of semiconductor devices. Problems associated with using the low energy electron beam to simulate 60Co exposure and a method for estimating the total absorbed dose in critical device oxides are discussed. The method is based on the experimentally determined expression for electron energy dissipation versus penetration depth in solid materials of Everhart and Hoff. An appendix giving the method of estimating the total absorbed dose in a form suitable for ASTM deliberations is included.
Author (GRA)

N78-17847# Science Applications, Inc., La Jolla, Calif.
MULTIMODE MODELING OF THE WATER MOLECULE Final Report
D. Rogovin, T. Stephens, and W. Wilson Aug. 1977 76 p refs Prepared in cooperation with Arizona Univ., Tucson
(Contract F29601-75-C-0132)
(AD-A047397; AD-E200051; AFWL-TR-76-253) Avail: NTIS HC A05/MF A01 CSCL 20/10

This report presents three approaches to multimode modeling water vapor. These are (1) A correlated bender approach that treats fluctuations in the bend angle as well as correlations of the bending mode with the OH stretch mode. Only a single effective nuclear coordinate is used. (2) A model that treats all three vibrational degrees of freedom, mode-mode coupling as well as molecular rotation. In addition, the effects of centrifugal distortion are included in a nonperturbative manner. (3) A phenomenological approach based on the concept of fitting the A, B, and C rotation matrices, both diagonal components, to the rotation-vibration energy levels. This approach, although phenomenological in nature is predictive. GRA

N78-17848# Air Force Geophysics Lab., Hanscom AFB, Mass.
ALGORITHM FOR THE CALCULATION OF ABSORPTION COEFFICIENT-PRESSURE BROADENED MOLECULAR TRANSITIONS
Shepard A. Clough, Francis X. Kneizys, and James H. Chetwyno, Jr. 22 Jul. 1977 64 p refs
(AF Proj. 2310)
(AD-A047515; AFGL-TR-77-0164; AFGL-ERP-607) Avail: NTIS HC A04/MF A01 CSCL 07/4

This report describes an algorithm for the accelerated computation of the convolution of a Lorentz line shape (pressure broadened) with spectral line data. A computational savings of approximately 10 has been achieved over conventional methods. The Lorentz function has been decomposed into three functions, each of which is convolved independently at optional sampling intervals. Criteria for the determination of the sampling interval of the Lorentz function for a resultant error of 0.1 percent is described. The report contains a listing of the computer program based on the algorithm and sample results in the spectral region 3550 to 3650/cm due to water and carbon dioxide.
Author (GRA)

N78-17849# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Reactor Physics.
DECAY CONSTANTS FOR PULSED MONOENERGETIC NEUTRON SYSTEMS WITH ANISOTROPIC SCATTERING
N. G. Sjoestrand Mar. 1975 17 p refs
(CTH-RF-28) Avail: NTIS HC A02/MF A01

The eigenvalue equation for monoenergetic neutron transport with linearly anisotropic scattering was solved numerically. The results are presented in the form of detailed tables and curves. The implications on pulsed neutron moderator experiments are discussed. In spite of sometimes doublevalued relationships between decay constant and buckling, it seems possible to interpret the experiments in a unique way through the use of extrapolation lengths. Author (ESA)

N78-17850# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Reactor Physics.
DECAY CONSTANTS FOR PULSED MONOENERGETIC NEUTRON SYSTEMS WITH QUADRATICALLY ANISOTROPIC SCATTERING
N. G. Sjoestrand Jun. 1977 22 p refs
(CTH-RF-30) Avail: NTIS HC A02/MF A01

The eigenvalues of the time-dependent transport equation for monoenergetic neutrons were studied numerically for various combinations of linearly and quadratically anisotropic scattering assuming a space dependence. The results, presented in the form of tables and graphs, show that quadratic anisotropy leads to a more complicated eigenvalue spectrum; however, no drastic changes occur in comparison to purely linear anisotropy.
Author (ESA)

N78-17851# Helsinki Univ. of Technology, Espoo (Finland). Lab. of Physics.
TEST OF RELATIVISTIC ANALOGUE OF INTERMEDIATE COUPLING
M. Suvanen and T. Aaberg 1977 14 p refs
(Rept-12/1977; ISBN-951-751-075-6) Avail: NTIS HC A02/MF A01

Multiconfiguration Dirac-Fock calculations of the energy and intensity ratio of K alpha hypersatellite X-ray lines are reported. They provide a basis for an accurate energy analysis of the transition energies and confirm a previous intermediate coupling analysis of the intensity ratio of K alpha lines. Author (ESA)

N78-17852# Helsinki Univ. of Technology, Espoo (Finland). Lab. of Physics.
RELAXATION AND FINAL-STATE CHANNEL MIXING IN THE AUGER EFFECT
G. Howat (Edinburgh Univ.), T. Aaberg, and O. Goscinski (Uppsala Univ.) 1977 26 p refs Sponsored partly by Imp. Chem. Ind., Sci. Res. Council, Finn. Acad. of Sci., and Swed. Natural Sci. Res. Council
(Rept-14/1977; ISBN-951-751-095-0) Avail: NTIS HC A03/MF A01

The conventional theory of the Auger effect, based on Wentzel's Ansatz, was generalized to incorporate relaxation and

final state channel mixing. An application to neon KLL Auger rates in LS-coupling was made. The bound state orbitals are generated by alternative self-consistent-field methods; the continuum orbital was solved in the field of the doubly ionized residual ion including full exchange. In accordance with Kelly's many-body-perturbation-theory calculation, it was found that the mixing between the final channels affects the various partial rates by 10 to 40 %. The effect of the non-orthogonal overlap elements was found to be of importance for various transitions. Since the Slater integrals involved were shown to be sensitive to the relevant orbitals, the importance of incorporating correlation effects in a systematic fashion is stressed. Author (ESA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N78-17853 Rochester Univ., N. Y.
A STUDY OF CHARMED QUARK Ph.D. Thesis
Tetsyya Goto 1977 243 p
Avail: Univ. Microfilms Order No. 77-25456

Possible ways in which strangeness changing weak neutral currents can be eliminated in conformity with the experimental evidence are discussed. One corresponds to the standard Generalized Information Management (GIM) model, the second leads to a new four flavor quark model. The possibility of getting rid of the lowest order weak contribution to the rare decays of the kaon, without appealing to extra charmed quarks, and without eliminating the neutral strangeness changing currents is studied. The second part of the thesis deals with charmed meson decays based on the GIM model of charm. A suitable generalization of a dynamical model first studied by Sakurai for nonleptonic decays of strange particles is used. The generalized model is used to calculate the rates for two or quasi-two body nonleptonic decays of charmed mesons. Dissert. Abstr.

N78-17854 Texas Univ., Austin.
MICROSCOPIC APPROACHES TO THE INTERMEDIATE ENERGY NUCLEON-NUCLEUS OPTICAL POTENTIAL Ph.D. Thesis
Robert Landon Ray 1977 138 p
Avail: Univ. Microfilms Order No. 77-29079

Two rather different applications of the theory of the optical potential for the scattering of intermediate energy nucleons by nuclei are discussed and compared in terms of their success, particularly in describing the overall energy dependence of the volume of the real part of the optical potential, as well as in describing the available proton elastic and inelastic scattering data at 1 GeV incident laboratory kinetic energy. The two resulting potentials differ in the treatment of the nucleon-nucleon scattering amplitude. In the first approach, the more conventional one, this amplitude is taken to be the free nucleon-nucleon scattering amplitude and crudely parameterized. In the second approach, the real part of the proton-nucleus optical potential is related to three-nucleon amplitudes, such as appear in nuclear-matter theory, which can be constructed in terms of an empirical nucleon-nucleon interaction. Dissert. Abstr.

N78-17855 Arizona Univ., Phoenix.
PROBLEMS IN MICROSCOPIC NUCLEAR EFFECTIVE INTERACTION CALCULATIONS Ph.D. Thesis
Margaret Frances Scrivner Sandel 1977 174 p
Avail: Univ. Microfilms Order No. 77-29353

Several commonly made approximations in microscopic effective interaction calculations result in serious inaccuracies. The effective interaction for A=18 nuclei was recalculated to eliminate these approximations. The calculation was performed through second order in the reaction matrix G. A selected third-order term was calculated to estimate the effect of the corrections on the apparent order by order convergence of the expansion. The major corrections made are: (1) A consistent unperturbed hamiltonian was used in the calculation of G and the perturbation expansion. (2) The summation over intermediate particle states was carried out to sufficiently high energy to insure that it has converged. (3) The correct starting energy (for the location in the diagram) was used in calculating all G interactions in the second and third order diagrams. Dissert. Abstr.

N78-17856*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPTIMIZE OUT-OF-CORE THERMIONIC ENERGY CONVERSION FOR NUCLEAR ELECTRIC PROPULSION
James F. Morris Sep. 1977 15 p refs Proposed for presentation at Intern. Conf. on Plasma Sci., Monterey, Calif., 15-17 May 1978; sponsored by IEEE
(NASA-TM-73892) Avail: NTIS HC A02/MF A01 CSCL 18E

Current designs for out of core thermionic energy conversion (TEC) to power nuclear electric propulsion (NEP) were evaluated. Approaches to improve out of core TEC are emphasized and probabilities for success are indicated. TEC gains are available with higher emitter temperatures and greater power densities. Good potentialities for accommodating external high temperature, high power density TEC with heat pipe cooled reactors exist. Author

N78-17857# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
ON THE EFFECT OF TRAPPED PARTICLES IN THE REGIME OF CYCLOTRON RESONANCE
L. Krlin Mar. 1976 19 p refs
(IPPCZ-211) Avail: NTIS HC A02/MF A01

The motion of particles in a finite amplitude wave, propagating obliquely to the homogeneous magnetostatic field is discussed. It follows from simple integral properties, that in the neighborhood of Doppler shifted cyclotron resonance similar trapping effects appear as in a plasma without magnetostatic field. Consequences of this trapping are discussed, in particular the possibility of a strong absorption of the wave and the origin of stochastic instabilities, caused by the perturbation of an effective trapping potential and leading to the acceleration of particles. Author

N78-17858# Helsinki Univ. of Technology, Espoo (Finland). Lab. of Physics.
SHAKING PROCESSES IN BETA DECAY
J. W. Cooper (NBS, Washington, D.C.) and T. Aaberg 1977 31 p refs
(Rept-13/1977; ISBN-951-751-094-2) Avail: NTIS HC A03/MF A01

A discussion of theoretical treatments of atomic rearrangement processes accompanying beta decay is presented. A schematic model for K shell ejection or excitation was developed; the expected accuracy of this model and other theoretical treatments using approximate wave functions is discussed. Comparison with experimental evidence reveals that there is some evidence of direct processes but that uncertainties in calculations exist for low energy processes. Author (ESA)

N78-17859# Brown, Boveri und Cie, A.G., Mannheim (West Germany).
DIGITAL PROCEDURE FOR COMPUTING AND OPTIMIZING THE PROTECTION OF VEHICLES AGAINST NUCLEAR RADIATION [DIGITALES VERFAHREN ZUR BERECHNUNG UND OPTIMIERUNG DES NUKLEARSCHUTZES VON FAHRZEUGEN]
R. W. Birkhahn and E. H. Brehm Bonn DOKZENTBw 1977 61 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVg-FBWT-77-8) Avail: NTIS HC A04/MF A01; DOKZENTBw DM 30

A speedy and economic technique was developed employing a computational procedure based on the beta-phi method, using results of transport calculations. Optimization is done by means of a gradient method, in which the vector of maximum dose diminution is to be calculated in every iteration step. The procedure for calculating and optimizing the nuclear shielding is fully automatic. The input values needed may be read directly from design drawings without manipulation. Author (ESA)

N78-17860# Nuklear-Chemie und -Metallurgie, G.m.b.H., Wolfgang Bei Hanau (West Germany).
INCREASED LIFETIME OF TRITIUM TARGETS BY TRITIUM REGENERATION [TRITIUM-TARGETS ERHOEHTER LEBENSDAUER DURCH TRITIUM-REGENERATION]
H. Fabian Bonn DOKZENTBw 1977 37 p In GERMAN; ENGLISH summary
(Contract T/RF-22/TF-220/21001)
(BMVg-FBWT-77-9) Avail: NTIS HC A03/MF A01; DOKZENTBw DM 30

Methods to increase the lithium target lifetime were studied. A first step towards the prolongation of the target standing time is represented by the use of rotating targets; these are targets with enlarged total surface, the focal spot remaining the same. A new method is the continuous regeneration of the target. Tritium is continuously applied to the target to compensate the tritium dilution caused by implanted deuterium. Studies with small prototypes were successful. An increase of the efficiency of the system seems possible. Author (ESA)

74 OPTICS

Includes light phenomena.

N78-17861 Rhode Island Univ., Kingston.
IMAGING OF VOLUME OBJECTS BY SHADOW CASTING Ph.D. Thesis
Roger Gregory Pridham 1977 180 p
Avail: Univ. Microfilms Order No. 77-24060

A technique for imaging the spatial distribution of radio isotopes consists of using coded apertures that enclose or partially enclose the object to cast shadow patterns on a recording media. For cylindrical and spherical shadowing configurations, the shadow pattern is shown to specify the three dimensional Fourier transform of the source on concentric cylinders or spheres. By appropriate aperture design, this sampling contains sufficient information to permit true volume reconstruction. The fundamental dimensionality-reduction question of how three-dimensional source information is encoded onto two dimensions is addressed and results for the cylindrical and spherical geometries are presented. Dissert. Abstr.

N78-17862 American Univ., Washington, D. C.
AN ANALYSIS OF ABERRATIONS OF THE V.L.A. RADIO SYNTHESIS TELESCOPE Ph.D. Thesis
Jerome Alan Hudson 1977 140 p
Avail: Univ. Microfilms Order No. 77-27437

When completed in the early 1980's, the Very Large Array will become the world's largest and most sensitive aperture synthesis radio telescope. Performance of any large telescope is limited by aberrations inherent in the optical design, by mechanical stability, and by the earth,s atmosphere. Aperture synthesis instruments are likewise limited by geometrical considerations, mechanical and electronic stability, and by the atmosphere. The aberrations arising from the geometry of the VLA were studied with a view to defining performance limitations, establishing parameters and guidelines for the computer programs used in making radio maps, and where possible, suggesting computational techniques for correcting or reducing aberrations. Dissert. Abstr.

N78-17863 Illinois Univ., Urbana-Champaign.
A THEORETICAL ANALYSIS OF A COMPLEX OPTICAL SPECTRUM ANALYZER Ph.D. Thesis
Walter James Atkins, Jr. 1977 132 p
Avail: Univ. Microfilms Order No. 77-26626

A system for measuring both the amplitude and phase of an optically produced Fourier transform is presented and analyzed. An interferometric technique is used to allow the computation of relative phase from measurements of spectral intensities. Possible sources of error within a realizable spectrum analyzer are modelled and analyzed. Equations are derived which predict the accuracy to be expected in measured amplitude and phase. A region is identified in the analyzer output plane where a Fourier transform produced by a thin converging lens is accurate to within a given specification. It is shown that vignetting can be made negligible by proper choice of the lens. The transverse coherence of the illuminating beam is shown to be a major limiting factor of analyzer accuracy. Dissert. Abstr.

N78-17864 Illinois Univ., Urbana-Champaign.
INFLUENCE OF ELECTROSTATIC FIELDS ON THE PROPERTIES OF ACOUSTICALLY TUNED OPTICAL FILTERS IN BULK CRYSTALS AND IN OPTICAL WAVEGUIDES Ph.D. Thesis
James Joseph Wiczer 1977 142 p
Avail: Univ. Microfilms Order No. 77-26779

Increased tuning range is achieved by including an electrostatic field component as a parameter of adjustment of acoustically tuned optical filters. In a LiNbO3 bulk crystal, the optical wavelength shifts the optical filter wavelength 2 A per kV/cm of applied electric field. This effect can be analytically extended to acoustooptic interactions in optical waveguides. The inherent limitations of efficient, narrow bandwidth surface acoustic wave transducers can be reduced, thus allowing for the fabrication of anisotropic Bragg diffraction devices in optical waveguides tunable over large optical ranges. Dissert. Abstr.

N78-17865* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
OPTICAL CONVERSION METHOD Patent
William E. Perry, inventor (to NASA) Issued 3 Jan. 1978 5 p Filed 21 Jan. 1976 Supersedes N76-18917 (14 - 09, p 1186
(NASA-Case-MSC-12618-1; US-Patent-4,067,043;
US-Patent-Appl-SN-651007; US-Patent-Class-358-55;
US-Patent-Class-358-41; US-Patent-Class-358-225;
US-Patent-Class-350-159) Avail: US Patent Office CSCL 20F

An optical pickup comprising an electrooptical device located between two crossed polarizing devices all positioned along a common optical axis is described for switching a TV system between a color mode and a black and white mode. Embodiments in which the electrooptical system is used as a neutral density filter, a selective color filter, or a light shutter as applied to a television camera are described. Where the optical system is used as a selective color filter to produce light beams of alternating color in a field sequential color television system, deactivation of the optical system renders the television a black and white system. Official Gazette of the U.S. Patent Office.

N78-17866* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
OPTICAL SCANNER Patent
David B. Rhodes, inventor (to NASA) Issued 20 Dec. 1977 4 p Filed 6 Apr. 1976 Supersedes N76-23985 (14 - 14, p 1855)
(NASA-Case-LAR-11711-1; US-Patent-4,063,814;
US-Patent-Appl-SN-674195; US-Patent-Class-356-28;
US-Patent-Class-250-201; US-Patent-Class-350-204) Avail: US Patent Office CSCL 02F

An optical scanner that sequentially focuses optical energy (light) at selected points in space is described. The essential component is a scanning wheel including several glass windows with each window having a different thickness. Due to this difference in thickness, the displacement of the emerging light from the incident light is different for each window. The scanner transmits optical energy to a point in space while at the same time receiving any optical energy generated at that point and then moves on to the next selected point and repeats this transmit and receive operation. It fills the need for a system that permits a laser velocimeter to rapidly scan across a constantly changing flow field in an aerodynamic test facility.
Official Gazette of the U.S. Patent Office

N78-17867* National Aeronautics and Space Administration. Pasadena Office, Calif.
DIFFERENTIAL OPTOACOUSTIC ABSORPTION DETECTOR Patent
Michael S. Shumate, inventor (to NASA) (JPL) Issued 10 Jan. 1978 8 p Filed 27 Aug. 1976 Supersedes N77-11363 (15 - 02, p 0194) Sponsored by NASA
(NASA-Case-NPO-13759-1; US-Patent-4,067,653;
US-Patent-Appl-SN-718266; US-Patent-Class-356-204;
US-Patent-Class-250-344; US-Patent-Class-356-246) Avail: US

Patent Office CSCL 20F

A differential optoacoustic absorption detector employed two tapered cells in tandem or in parallel. When operated in tandem, two mirrors were used at one end remote from the source of the beam of light directed into one cell back through the other, and a lens to focus the light beam into the one cell at a principal focus half way between the reflecting mirror. Each cell was tapered to conform to the shape of the beam so that the volume of one was the same as for the other, and the volume of each received maximum illumination. The axes of the cells were placed as close to each other as possible in order to connect a differential pressure detector to the cells with connecting passages of minimum length. An alternative arrangement employed a beam splitter and two lenses to operate the cells in parallel. Official Gazette of the U.S. Patent Office

N78-17868*# Cornell Univ., Ithaca, N. Y. Center for Radiophysics and Space Research.

PROCEDURES FOR DEALING WITH CERTAIN TYPES OF NOISE AND SYSTEMATIC ERRORS COMMON TO MANY HADAMARD TRANSFORM OPTICAL SYSTEMS Final Report, 1 Dec. 1975 - 30 Nov. 1977

Martin Harwit 30 Nov. 1977 48 p refs
(Grant NsG-1263)
(NASA-CR-155927; CRSR-684) Avail: NTIS HC A03/MF A01 CSCL 20F

Sources of noise and error correcting procedures characteristic of Hadamard transform optical systems were investigated. Reduction of spectral noise due to noise spikes in the data, the effect of random errors, the relative performance of Fourier and Hadamard transform spectrometers operated under identical detector-noise-limited conditions, and systematic means for dealing with mask defects are among the topics discussed. The distortion in Hadamard transform optical instruments caused by moving masks, incorrect mask alignment, missing measurements, and diffraction is analyzed and techniques for reducing or eliminating this distorion are described. J.M.S.

N78-17869# Catholic Univ. of America, Washington, D. C. Vitreous State Lab.

BULK AND IMPURITY INFRARED ABSORPTION IN 0.5 As2Se3 - 0.5 GeSe2 GLASSES Technical Report, Apr. 1976 -Sep. 1977

P. S. Danielson and C. T. Moynihan Oct. 1977 21 p refs
(Contract N00014-76-C-0201)
(AD-A047879; TR-35) Avail: NTIS HC A02/MF A01 CSCL 11/2

A study of infrared absorption in the 250 to 4000/cm region has been carried out for 0.5 As2Se3-0.5 GeSe2 glasses quantitatively doped with oxide impurity. The frequencies of the intrinsic 2- and 3-phonon absorption bands at 490 and 690/cm correspond well to those predicted from combinations of the high frequency bands in the first order IR and Raman spectra of As2Se3 and GeSe2 glasses. Glasses doped with As2O3 exhibit the same oxide impurity absorption bands as those doped with GeO2. Unlike As2Se3 glass, at impurity concentrations up to 100 ppm AS2O3, 0.5 As2Se3 - 0.5 GeSe2 glass exhibits only one major oxide impurity species, characterized by absorption bands at 780 and 1260/cm and due to oxygen bonded to network Ge. The observation of a much weaker network As-O vibration band at 670/cm confirms that oxygen bonds preferentially to Ge in this glass. The same minor oxide species appears to determine excess IR absorption at the CO2 laser wavelength of 10.6 micrometers in both As2Se3 and 0.5 As2Se3-0.5 GeSe2 glasses. The frequencies and intensities of absorption bands due to hydrogen impurities are also quite comparable for these two materials. Author (GRA)

N78-17870# Naval Research Lab., Washington, D. C. Material Sciences Div.

OPTICAL RECORDING CHARACTERISTICS OF KF: LiF PHOTODICHROIC CRYSTALS Interim Report

William C. Collins, Michael J. Marrone, and Michael E. Gingerich 18 Oct. 1977 33 p refs
(AD-A047832; AD-E000070; NRL-8168) Avail: NTIS HC A03/MF A01 CSCL 20/6

An analysis was made of the optical recording and readout characteristics of the photodichroic KF:LiF crystal containing F sub A defects as the activated medium. The results of a series of measurements indicate, in agreement with the analysis, that this crystal system has the highest photosensitivity of any direct reversible recording material without a gain mechanism (approx. 1 mJ/sq. cm.). The modulation transfer function for a 200-micrometers-thick activated layer was measured to be 40% at 75 lines/mm, and the dynamic range exceeded 40 db. The crystal can be operated fatigue free at 220 K by use of thermoelectric coolers, although optimum performance is predicted for a temperature of about 100 K. The wavelength range of photosensitivity lies in the blue and green and matches the argon laser lines. Author (GRA)

N78-17871# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

DESIGN AND EVALUATION OF COUPLERS FOR A MULTIMODE SINGLE FIBER OPTICAL DATA BUS M.S. Thesis

Michael C. Ogan Oct. 1977 84 p refs
(AD-A047773; AFIT-GEO/PH/77-2) Avail: NTIS HC A05/MF A01 CSCL 20/6

The fiber optic couplers designed and evaluated in this thesis are intended primarily for use in aircraft avionics systems, and consist of single strand, multimode fibers with step index profiles. Types of couplers considered are the directional, tee, and star couplers, with emphasis on the latter. Several designs are fabricated and tested, including three kinds of star couplers. The first employed a mixing rod of transparent cement and yielded an average transmission factor of 0.009 (-20.5 db), with an average insertion loss of -12.83 db. The second was formed with a solid quartz mixing rod, producing an average transmission factor of 0.003 (-25.2 db) and an average insertion loss of -18.01 db. The third star coupler's mixing rod was made by fusing the individual fibers, resulting in an average transmission factor of 0.01 (-20.0 db) and an average insertion loss of -12.35 db. After theoretical and experimental comparisons between performance efficiencies, the third coupler is recommended as an optimum design for a fiber optic data bus system. Author (GRA)

N78-17872# Fairchild Imaging Systems, Syosset, N. Y.

CCD PERISCOPE PROGRAM Final Report, May 1975 - May 1977

6 Jun. 1977 160 p refs
(Contract N00039-75-C-0410)
(AD-A048260; ED-AX-82) Avail: NTIS HC A01/MF A01 CSCL 17/8

A key objective of the Day/Night Periscope program was to demonstrate the feasibility of using charge coupled devices to provide low light level, high resolution sensing in periscopes that would solve operational surveillance problems. The procedures used to demonstrate feasibility were two specified investigations, i.e., High Resolution Scanning and Integrating Mode Low Light operation, using a 1 x 1728 linear CCD sensor and a 128 x 128 TDI CCD Integrating Mode Sensor, respectively. In addition, the following design studies were specified: (1) analysis of Navy field results to aid in defining an image stabilization system, (2) a design study of 'real time' and 'replay' display configurations, and (3) a preliminary system definition for the CCD Periscope. GRA

N78-17873# National Oceanic and Atmospheric Administration, Boulder, Colo.

STELLAR SCINTILLOMETER MODEL 2 FOR MEASUREMENT OF REFRACTIVE-TURBULENCE PROFILES

G. R. Ochs, Ting-I Wang, and F. Merrem Apr. 1977 24 p refs Sponsored by RADC
(PB-273921/7; NOAA-TM-ERL-WPL-25; NOAA-77092205) Avail: NTIS HC A02/MF A01 CSCL 04A

An optical system for measuring refractive-turbulence profiles in the atmosphere is described. The instrument measures the profile along the light path to a star by analyzing the scintillation of the star by the atmosphere, and is an improved version of an earlier system. The circuit diagram, computer program, and operating instructions for the instrument are included. GRA

N78-17096*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ULTRAVIOLET ABSORPTION: EXPERIMENT MA-059
T. M. Donahue (Michigan Univ.), R. D. Hudson, W. T. Rawlins (Pittsburgh Univ.), J. Anderson (Michigan Univ.), F. Kaufman (Pittsburgh Univ.), and M. B. McElroy (Harvard Univ.) *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 109-126 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 20F

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N78-17874 Polytechnic Inst. of New York.
STUDIES OF PARAMETRIC DECAY INSTABILITIES IN MAGNETO PLASMA Ph.D. Thesis
Szu-Ping Kuo 1977 97 p
Avail: Univ. Microfilms Order No. 77-21074

A general formulation of the parametric coupling equations was developed by using the Hamiltonian approach. The plasma was pumped by a monochromatic electromagnetic wave which decays into a plasmon and a phonon. Either one of the plasma modes coupled with the pump wave to induce a polarization act as the source of another mode. A general procedure to calculate the induced polarizations was introduced by transforming the linearized Vlasov equation into the oscillating frame of reference, in which the equation was then solved by the method of characteristics. The threshold power, initial growth rate and the frequency shift of the parametric instabilities can be obtained from the coupled mode equations and the results obtained can be applied to all the wavelength region. Dissert. Abstr.

N78-17875 Wisconsin Univ., Madison.
DEVELOPMENT OF A ONE DIMENSIONAL FLUID TRANSPORT MODEL AND THE ANALYSIS OF THERMAL STABILITY IN LARGE TOKAMAKS Ph.D. Thesis
Wayne Arthur Houlberg 1977 196 p
Avail: Univ. Microfilms Order No. 77-17834

The one dimensional fluid particle and energy balance equations for a Tokamak plasma consist of a set of coupled, nonlinear, parabolic partial differential equations. The numerical techniques were designed to provide a combination of speed and accuracy in solving these equations while avoiding numerically induced oscillations and instabilities. A non-uniform spatial mesh is employed to allow more accurate calculations in the boundary of reactor size plasmas without paying the penalty associated with using a large number of radial zones throughout the plasma. A box integration method maintains the accuracy of central differencing for the diffusion and conduction flow terms. A variable implicit technique was used for the time expansion. Sample calculations for a conceptual Tokamak power reactor and a nearer term Tokamak engineering test reactor were made using a trapped particle microinstability model for particle and energy transport. Dissert. Abstr.

N78-17876 Cornell Univ., Ithaca, N. Y.
PLASMA HEATING BY A RELATIVISTIC ELECTRON BEAM: AN EXPERIMENTAL STUDY Ph.D. Thesis
Michael Alter Greenspan 1977 289 p
Avail: Univ. Microfilms Order No. 77-28379

A relativistic electron beam was injected through an anode foil into a highly ionized hydrogen plasma column. Experiments were conducted to systematically measure the plasma heating achieved as a function of plasma density, beam current, and beam velocity scatter. Further experiments were performed to study the heating mechanism. The plasma before beam heating was diagnosed with four and eight millimeter microwave interferometry and H(0) neutral beam attenuation to determine the integrated line density across the column. Langmuir probe studies were done to find the radial density profile, enabling calculation of the absolute density from the integrated density. Dissert. Abstr.

N78-17877 Princeton Univ., N. J.
A STUDY OF DRIFT, ALFVEN AND TEARING MODES IN A NONUNIFORM PLASMA WITH SHEARED MAGNETIC FIELDS Ph.D. Thesis
Jang-yu Hsu 1977 149 p
Avail: Univ. Microfilms Order No. 77-28105

Some relatively unexplored features of several interesting low-frequency instabilities of relevance to a toroidal plasma confinement device are investigated. Drift instabilities in a uniformly sheared magnetic field are discussed. A new instability which can produce a local breakup of the rational magnetic surface is discussed. A detailed calculation of this instability in a nonuniform plasma with magnetic shear is presented. The influence of a given saturated microturbulence of electrostatic drift waves on the stability of long-scale-length magnetohydrodynamic modes like the tearing mode is investigated. It is concluded that even a small-amplitude background turbulence is sufficient to strongly modify the growth rate. Dissert. Abstr.

N78-17878# Lockheed Missiles and Space Co., Palo Alto, Calif.
VIBRATIONAL NONEQUILIBRIUM IN GASES
A. I. Osipov [1978] 19 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (USSR), v. 33, no. 5, 1977 p 935-949
Avail: NTIS HC A02/MF A01; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The kinetic theory of gases which describes the state of incomplete statistical equilibrium due to the nonequilibrium energy distribution over the vibrational degrees of freedom is discussed. The vibrational relaxation processes, which shape the equilibrium or nonequilibrium vibrational distributions, proceed considerably more slowly than the equilibrium build-up processes in the translational and rotational degrees of freedom, and considerably more rapidly than chemical reactions. In a first approximation, this permits considering vibrational relaxation isolated in the background of the already terminated rapid processes of equilibrium build up in the translational and rotational degrees of freedom and the chemical reactions which still have not started. The comparative slowness of the vibrational relaxation governs its exceptional role in the production of molecular media with a population inversion, and in the shaping of the quasistationary distribution which permits active interference during the chemical reaction. Author

N78-17879# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
ELECTRON EIGEN-OSCILLATIONS AND BALLISTIC MODES OF A STABLE PLASMA
K. Jungwirth Jan. 1976 18 p refs
(IPPCZ-208) Avail: NTIS HC A02/MF A01

The relation between the plasma response on singular and regular initial perturbations is established. Time scaling is introduced to separate time intervals for which eigen-oscillations (Landau solution) are dominant from those, where ballistic modes prevail. The enhanced role of the ballistic models for an initially perturbed field-free plasma is demonstrated, too, including the phenomenon of plasma waves echoes. Author

N78-17880# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
THE 9TH CZECHOSLOVAK SEMINAR ON PLASMA, PHYSICS AND TECHNOLOGY
May 1976 102 p refs Partly in ENGLISH and RUSSIAN Seminar held at Liblice, Czechoslovakia, 31 Mar. - 2 Apr. 1976 (IPPCZ-213) Avail: NTIS HC A06/MF A01

Studies dealing with particle physics, plasma physics, and discharges are presented. Applications described include plasma cluster acceleration, materials processing, and contributions to the theory of the development of solar flares. Several papers discuss ionization and dissociative recombination. P.R.A.

N78-17881# Naval Research Lab., Washington, D. C. Plasma Dynamics Branch.
NONLINEAR THEORY OF THE COLLISIONAL RAYLEIGH-TAYLOR INSTABILITY IN EQUATORIAL SPREAD F Interim Report
P. K. Chaturvedi (Maryland Univ., College Park) Aug. 1977 34 p refs
(AD-A047402; AD-E000041) Avail: NTIS HC A03/MF A01 CSCL 20/9

The nonlinear behavior of the collisional Rayleigh-Taylor

instability is studied in equatorial Spread F by including a dominant two-dimensional nonlinearity. It is found that on account of this nonlinearity, the instability saturates by generating damped higher spatial harmonics. This saturated power spectrum for the density fluctuations goes like 1/k squared. A comparison between experimental observations and theory is presented. Author (GRA)

N78-17882# California Univ., Los Angeles. Dept. of Physics.
PROPERTIES OF LARGE AMPLITUDE LANGMUIR SOLITONS
M. DEvelyn and G. Morales Oct. 1977 61 p refs
(Contract N00014-75-C-0476)
(AD-A048054; PPG-318) Avail: NTIS HC A04/MF A01 CSCL 20/9

This numerical study isolates some of the experimentally interesting properties of the large amplitude spatially localized electric fields in the Langmuir frequency range which are described by the non-linear Schrodinger equation with the full exponential nonlinearity retained. The steady state eigenvalues and wavefunctions are calculated and their properties compared with the small amplitude soliton solutions. A variety of time dependent effects are investigated in both bounded and unbounded geometries. Some of these are: the evolution of initial standing waves; the collisional properties; the pumping of stationary, moving, and colliding solitons by a uniform external electric field. GRA

N78-17883# Naval Research Lab., Washington, D. C.
RAYLEIGH-TAYLOR INSTABILITY IN A LAYERED LASER-DRIVEN TARGET Interim Report
F. S. Felber Sep. 1977 21 p refs
(AD-A047806; AD-E000027; NRL-MR-3506) Avail: NTIS HC A02/MF A01 CSCL 18/1

Growth rates of Rayleigh-Taylor modes, particularly those of long wavelength, are reduced at fluid interfaces in inhomogeneous laser-driven targets by the density gradients occurring naturally as a result of the acceleration. Growth rates can be reduced further by interposing layers of intermediate density at unstable interfaces between layers of high and low density, and by fabricating target layers with favorable density gradients between discontinuities. An approximate closed form expression for the growth rate of fluid instabilities in a multi-layered laser-driven target is presented. Author (GRA)

N78-17884# Naval Research Lab., Washington, D. C. Plasma Physics Div.
GENERATION OF A REVERSED-FIELD PLASMA, CONFINEMENT CONFIGURATION WITH A ROTATING RELATIVISTIC ELECTRON BEAM Interim Report
J. D. Sethian, D. A. Hammer, K. A. Gerber, D. N. Spector (Md. Univ., College Park), A. E. Robson, and G. C. Goldenbaum Nov. 1977 42 p refs
(AD-A047822; AD-E000069; NRL-MR-3648) Avail: NTIS HC A03/MF A01 CSCL 20/9

A reversed field plasma confinement geometry was produced by plasma currents induced by a rotating relativistic electron beam injected into 85 M torr neutral hydrogen. The resulting belt-pinch-like configuration has a rectangular cross section, with length to width ratio of 20 and a midplane zeta = .5. An equilibrium model, fitted to measurements of the excluded flux and induced axial and aximuthal magnetic fields, is in agreement with the annular plasma profile observed with T radial Thomson scattering scans, CO2 interferometers, and end-on streak photographs. After beam passage, the axial field remains constant for 5 micron sec until the aximuthal magnetic field becomes small, at which time the plasma collapses radially. GRA

N78-17885# Naval Research Lab., Washington, D. C. Plasma Physics Div.
CROSS FIELD THERMAL TRANSPORT DUE TO ION ACOUSTIC WAVES IN MAGNETIZED LASER PLASMAS Interim Report
Wallace M. Manheimer, Claire E. Max (Calif. Univ., Livermore. Lawrence Livermore Lab.), and Jeffery Thomson (Calif. Univ., Livermore. Lawrence Livermore Lab.) Sep. 1977 25 p refs (Contract E(49-20)-1006)
(AD-A047818; AD-E000025; NRL-MR-3593) Avail: NTIS HC A02/MF A01 CSCL 18/1

It is shown that cross field temperature gradients can drive ion acoustic waves unstable in a laser produced plasma. The principle effect of the instability is an enhancement of the cross field thermal conductivity. It is shown how this effect can be modeled in laser fusion hydrocodes. Author (GRA)

N78-17886# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
THE ROLE OF ELECTROSTATIC INSTABILITIES IN THE CRITICAL IONIZATION VELOCITY MECHANISM
M. A. Raadu Jul. 1977 25 p refs Sponsored by Swed. Atomic Res. Council
(TRITA-EPP-77-18) Avail: NTIS HC A02/MF A01

Analysis was based on the theory developed by Sherman which interprets Alfven's critical velocity in terms of a circular process. This process involves the acceleration of electrons by a two-stream instability modified by the presence of a magnetic field. A general expression for the energy and momentum of ions and electrons associated with an electrostatic mode is derived in terms of the plasma dielectric constant. This is used in the case of the modified two-stream instability to determine the distribution of energy between ions and electrons. An extrapolation from the linear phase then gives an estimate of the energy delivered to the electrons which is compared to that required to ionize the neutral gas. Author (ESA)

N78-17887# Technical Research Centre of Finland, Espoo. Nuclear Engineering Lab.
ONE-DIMENSIONAL PLASMA SIMULATION STUDIES
Ari Friberg (Rochester Univ. N.Y.) and Jorma Virtamo 1976 21 p refs
(VTT-ENT-15; ISBN-951-38-0394-5) Avail: NTIS HC A02/MF A01

Some basic plasma phenomena are studied by a one-dimensional electrostatic simulation code. The code and its application to a test problem is described in brief. The experiments carried out include Landau damping of an excited wave, particle retardation by smoothed field, and beam plasma instability. In each case, the setup of the experiment is described and results are compared with theoretical predictions. In the theoretical discussions, the oscillatory behavior found in the Landau damping experiment is explained, an explicit formula for the particle retardation rate is derived, and a rudimentary picture of the beam-plasma instability in terms of quasilinear theory is given. Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N78-17888 Pittsburgh Univ., Pa.
ENERGY DEPENDENCE OF ANOMALIES OF Er-168 (d,t)Er-167 TRANSITIONS Ph.D. Thesis
Hawshie Song 1977 94 p
Avail: Univ. Microfilms Order No. 77-23550

Angular distribution as measured for the residual states of ER-167 populated through the (d,t) reaction with 17, 15, 13, 11, and 9 MeV deuterons. Most of the angular distributions are well reproduced by Distorted Wave Born Approximation (DWBA) with orbital angular momentum transfer lambda which are compatible with the previously assigned spin-parities of the states in all incident beam energies. A significant number of angular distributions either cannot be fitted by any resonable DWBA calculation or can only be fitted with a calculation by assuming a lambda value incompatible with the previous Nilsson assignment of the state. These anomalies have interesting energy dependence behaviors. There also exists some deviations between measured and calculated well-fitted angular distributions. Dissert. Abstr.

N78-17889 Rensselaer Polytechnic Inst., Troy, N. Y.
A STUDY OF CHLORIDE ETCHING IN THE EPITAXY OF THIN GALLIUM ARSENIDE LAYERS Ph.D. Thesis
Rajaram Bhat 1977 144 p
Avail: Univ. Microfilms Order No. 77-23776

The use of HCl gas and AsCl3 vapor for in situ etching of GaAs substrates was investigated. Specular surfaces, suitable for epitaxy, were obtained for substrates doped with Cr, Te, Si, and Zn with either HCl gas or AsCl3 vapor. The etching reaction was mass transport limited at temperatures above 870 C for both (100) and (111) surfaces. At lower temperatures, faceting resulted from the unequal etch rates for the different orientations. The growth rate of epitaxial layers can be increased by a factor of two while retaining specular surfaces if in situ etching was performed prior to growth. The carrier concentration decreased with epitaxial layer thickness, for layers on AsCl3 etch substrates. Contaminants present in the HCl gas, however, caused an increase in the carrier concentration, particularly near the interface, for epitaxial layers on HCl gas etched substrates. Dissert. Abstr.

N78-17890 Florida Univ., Gainesville.
PRESSURE DEPENDENCE OF THE NUCLEAR QUADRUPOLE COUPLING CONSTANT AND THE KNIGHT SHIFT OF SINGLE CRYSTAL GALLIUM Ph.D. Thesis
James Ying-Che Hwang 1977 90 p
Avail: Univ. Microfilms Order No. 77-25936

The nuclear quadrupole coupling tensor at temperatures of 273 K, 198 K, and 77 K, and the Knight shift tensor at a temperature of 77 K of gallium metal were measured as a function of hydrostatic pressure up to 7 Kbars, by employing nuclear quadrupole and nuclear magnetic resonance techniques. Single crystal samples were used to determine the electric field gradient asymmetry parameter and all the components of the Knight shift tensor. Hydrostatic pressure at low temperature was achieved by using a helium gas pressure system. The volume dependence of the isotropic Knight shift was found to be V sup 4.95. The pressure dependence of the Knight shift and that of the spin-lattice relaxation time of gallium conforms to the Korringa relation. The thermal expansion contribution and the explicit temperature dependence of the electric field gradient and the Knight shift were also separated by using published temperature dependent data. Dissert. Abstr.

N78-17891 Montana State Univ., Missoula.
ANGLE RESOLVED PHOTOEMISSION OF SINGLE CRYSTAL SnO2 USING SYNCHROTRON RADIATION Ph.D. Thesis
Peter Leland Gobby 1977 164 p
Avail: Univ. Microfilms Order No. 77-25626

Using photon energies up to 40 eV angle-integrated data revealed a total valence band width of approximately 9 electron volt (eV), with a large density of states centered about 1.5 eV below the valence band maximum due to oxygen 2p states. A core level and its associated excitons were also investigated and have been interpreted as due to tin 4d levels. Angle-resolved measurements allowed certain lower valence band structures to be emphasized which also showed strong polarization dependences. These structures have also been interpreted as due to tin 4d states. Another initial state feature just above the valence band maximum was studied and has been interpreted as due to a large concentration of oxygen vacancies near the surface. Dissert. Abstr.

N78-17892 American Univ., Washington, D. C.
SPIN FLUCTUATIONS AND THE PARAMAGNETIC-FERROMAGNETIC TRANSITION IN PALLADIUM-RHODIUM-NICKEL ALLOYS Ph.D. Thesis
Darrell James Gillespie 1977 290 p
Avail: Univ. Microfilms Order No. 77-27436

Low-temperature low-field magnetization and low-temperature zero-field electrical resistivity measurements were made on a series of palladium-rhodium-nickel alloys. At 4k the magnetization measurements were extended to 56 kG, and in the case of the more dilute alloys the resistivity measurements were extended to 300 K. Curie temperatures and spontaneous magnetization obtained by an Arrott plot analysis of the magnetization data yield a critical concentration for the onset of ferromagnetism of 1.9 + or - 0.05 at % Ni. In the paramagnetic region the magnetization, susceptibility, and resistivity are fitted by a model which considers local spin fluctuations to be associated with two types of magnetic center: a pair of interacting Ni atoms and a single noninteracting Ni atom. The local enhancement associated with a Ni pair is found to be roughly 3 to 4 times as large as that of noninteracting Ni atoms. Dissert. Abstr.

N78-17893 Minnesota Univ., Minneapolis.
CATION SURFACE SELF-DIFFUSION STUDIES OF CALCIUM OXIDE SINGLE CRYSTAL Ph.D. Thesis
Tae Yong Kim 1977 120 p
Avail: Univ. Microfilms Order No. 77-26120

Cation surface diffusion was measured on (100) and (110) surfaces of CaO single crystals in the temperature range 780 C - 1260 C using radioactive Ca 45 as the tracer. An aperture counting technique was employed to obtain tracer concentration profiles. Surface diffusion coefficients were obtained from the profile by use of Rosolowski's analysis which considered volume diffusion effects. The activation energy was found to be smaller than those observed in other oxides which were studied by the mass transfer technique. A surface vacancy mechanism is proposed as the cation surface diffusion mechanism for CaO. The proposed mechanism is supported by the dominance of Schottky defects in the interior of CaO. The measured value of pre-exponential factor is in good agreement with the calculated one based on the theory of surface vacancy mechanism. Dissert. Abstr.

N78-17894 Stevens Inst. of Tech., Hoboken, N. J.
CONVERSION ELECTRON MOSSBAUER STUDIES OF AMORPHOUS Fe-Si THIN FILMS Ph.D. Thesis
Robert Stephen Oswald 1977 88 p
Avail: Univ. Microfilms Order No. 77-26943

In FeSi the Mossbauer spectra of as-deposited, amorphous films were characterized by larger values of quadrupole splitting and wider lines than in the crystallized films. The isomer shift remained essentially unchanged after the amorphous-to-crystalline transition. The amorphous films exhibited an apparent size effect revealed by larger quadrupole splitting and line with decreasing film thickness. An Fe-rich, nonstoichiometric FeSi film exhibited a nonmagnetic, two-line spectrum in the amorphous state but changed to an apparent magnetic hyperfine spectrum upon annealing. The amorphous-to-crystalline transition in the FeSi2 films revealed a more complex phenomenon than a simple alpha-to-beta phase transformation. The film results were generally interpreted in terms of an amorphous structure characterized by a distribution of quadrupole splittings and a change in the local atomic volume. Dissert. Abstr.

N78-17895 Maryland Univ., College Park.
MIGRATION BY FORSTER TRANSFERS IN A RANDOM CONFIGURATION, AND SERIES EXPANSIONS FOR CONTINUUM PERCOLATION PROBLEM Ph.D. Thesis
Steven William Haan 1977 151 p
Avail: Univ. Microfilms Order No. 77-29146

The migration of electronic excitation by Forster transfers between randomly arrayed molecules was considered. A power series in number density for the Green function of the configuration averaged probability density for the location of an excitation was derived. A scaling law relating the density and time dependences implied that this was also a small time expansion. A partial summation of the series was used to show that the probability density satisfied a generalized diffusion equation. Numerical results to second order are presented for the probability that at time t an excitation was on its original point, and for the mean squared displacement of an excitation from its initial location. The former result is presented in a manner determined by the generalized diffusion equation: it is best approximated by expanding the inverse of its Laplace transform. The mean square displacement was related to the kernel of the generalized diffusion equation. Dissert. Abstr.

N78-17896 Virginia Univ., Charlottesville.
IMPURITY TRAPPING DURING CRYSTAL GROWTH Ph.D. Thesis
Allan Stuart Myerson 1977 170 p
Avail: Univ. Microfilms Order No. 77-28603

A computer simulation of dendritic crystal growth was developed and used to derive a relationship between solution trapping and system and process parameters during crystal growth. The relation predicts that trapping will increase with increasing crystal growth velocity and decreasing positive and negative temperature gradients. A flow crystallizer was used to experimentally study the growth of calcium sulphate, potassium aluminum sulfate, and sodium chloride aqueous solution. Significant amounts

of trapped water (up to 90 mole percent) were found in all systems. These data as well as data from the literature for organic, metallic, and inorganic systems were used to test the computer-derived relation which was found to correlate the data well.
Dissert. Abstr.

N78-17897 Iowa Univ., Iowa City.
MAGNETIC SUSCEPTIBILITY STUDY OF INTERMEDIATE VALENCE IN THE ALLOY SYSTEM SmSb(x)S(1-x) Ph.D. Thesis
Robert Brooke Beeken 1977 131 p
Avail: Univ. Microfilms Order No. 77-28430

A series of solid solutions, SmSb sub x S sub (1-x) were prepared by quenching from the molten state. Room temperature lattice parameter and magnetic susceptibility measurements strongly suggest that the samarium ions in the alloy samples exist in an intermediate valence configuration. An analysis of the lattice parameter deviations from Vegard's Rule indicates a conduction electron concentration of approximately 0.1 electron/samarium throughout most of the alloy composition range. Alloy samples with small Sb concentrations yield magnetic susceptibility data consistent with an interpretation that some samarium ions within the crystal are stabilized in the trivalent state. In addition, the magnetic susceptibility measurements performed on the alloy with x = 0.15 indicates the possible existence of a small temperature-induced valence change near T = 160K in this sample. Dissert. Abstr.

N78-17898 Washington Univ., Seattle.
NMR STUDY OF HYDROGEN IN INERT LIQUIDS AND SOLIDS Ph.D. Thesis
Mark Stephen Conradi 1977 226 p
Avail: Univ. Microfilms Order No. 77-30153

Molecular hydrogen was studied experimentally as a dilute impurity in liquid and solid inert hosts, using pulsed proton magnetic resonance. Specifically, liquid Neon, Argon, and Krypton were used as host solvents, as well as solid Neon, Argon, Krypton, and para-hydrogen. Dilute solutions of H2 in rare gas liquids were prepared by a vapor recirculation equilibrium technique. These dilute solutions were used so that the data would reflect the behavior of an isolated hydrogen molecule in an otherwise pure fluid. Direct determinations of the H2 diffusion coefficient were performed. Measurements were made at many temperatures in each liquid, ranging over the entire triple point to critical point temperature intervals. The data reported here are compared with the hosts' self-diffusion and the diffusion of other impurities in inert liquids, both measured by other workers. Dissert. Abstr.

N78-17899 Cornell Univ., Ithaca, N. Y.
MULTICRITICAL CROSSOVER SCALING FUNCTIONS Ph.D. Thesis
Eytan Domany 1977 212 p
Avail: Univ. Microfilms Order No. 77-28201

The critical behavior of a system is investigated, for example an antiferromagnet, which displays a multicritical point of bicritical or tetracritical character. Crossover sealing functions for the most important thermodynamic functions are calculated, to first order in e = 4 - d, where d is the dimensionality of space, and displayed graphically. The mechanism by which an irrelevant cubic perturbation induces tetracritical behavior is investigated and clarified. The differential recursion relations are solved to O(e), up to a point where one or more components of the order parameter are no longer critical. Those components are then integrated out, yielding a reduced Hamiltonian for the remaining components. The procedure is then repeated; the new recursion relations being again integrated until the remaining components become noncritical. The results are thus matched onto a noncritical system that can be treated perturbatively. Dissert. Abstr.

N78-17900 Yale Univ., New Haven, Conn.
MAGNETIC PHASE TRANSITIONS IN DYSPROSIUM ALUMINUM GARNET Ph.D. Thesis
Nicholas Joseph Giordano 1977 361 p
Avail: Univ. Microfilms Order No. 77-28030

The Ising-like antiferromagnet dysprosium aluminum garnet (DAG) is a somewhat unusual material in that it is possible for an applied magnetic field to couple directly to the antiferromagnetic order parameter. This coupling is known as an induced staggered field since in normal antiferromagnets only a staggered magnetic field can couple to the order parameter. The microscopic origin of this effect is discussed and quantitative calculations of the effect in DAG are presented. Dissert. Abstr.

N78-17901 Notre Dame Univ., Ind.
THE DYNAMIC MAGNETOELASTIC BEHAVIOUR OF MICROCRYSTALLINE Ni, Dy, AND Tb FILMS Ph.D. Thesis
Steven Carl Hart 1978 222 p
Avail: Univ. Microfilms Order No. 77-28178

Magnetoelastic excitations in ferromagnetic nickel, dysprosium, and terbium films were observed using conventional pulse-echo spectrometers in the frequency ranges 5.5 to 5.8 and 8.9 to 9.2 GHz. The magnetoelastic excitation intensities were investigated as a function of the magnitude and orientation of the applied magnetic field. Microwave absorption data were also obtained as a function of applied field for the various magnetic field configurations. In order to perform the experiments on dysprosium and terbium, a superconducting solenoid field controller was also developed. The longitudinal and transverse signal intensities are discussed as well as the maximum absorption signal for each metal. Dissert. Abstr.

N78-17902 Cornell Univ., Ithaca, N. Y.
NONLINEAR OPTICAL SPECTROSCOPY IN THE EXCITONIC REGION OF CADMIUM SULFIDE Ph.D. Thesis
Janet Lehr Jackel 1977 167 p
Avail: Univ. Microfilms Order No. 77-29369

Linear and nonlinear optical properties of CdS in the excitonic region were investigated and the relationships between these properties were exploited to construct a detailed picture of the nonlinear optical response of the material. Nonlinear response in CdS was probed by measuring the strength of second harmonic generation and two-photon absorption as a function of input wavelength and of the relative orientations of crystal optic axis, input polarization, and direction of propagation for each input beam. For these measurements a tunable dye laser was constructed. Measurements were made with two-photon energies of 2.5686 - 2.58 eV, i.e., in the range of the B, n=1 and A, n=2 excitons. Dissert. Abstr.

N78-17903 Cornell Univ., Ithaca, N. Y.
STRUCTURAL PROPERTIES OF SIMPLE METALS UNDER NORMAL AND EXTREME CONDITIONS Ph.D. Thesis
David Martin Straus 1977 229 p
Avail: Univ. Microfilms Order No. 77-28413

The density-density correlation function for a simple metal was calculated in order to evaluate the ionic structure factor and the x-ray scattering cross section for sodium (at T = 0 K and 90 K) and lithium (both isotopes at T = 0 K) within the harmonic approximation. The problem of the most stable lattice structure of metallic hydrogen (at p = 1.7 megabars and T = 0 K) is the thermodynamic functions and phase separation boundaries of solid metallic hydrogen-helium alloys at temperatures between 0 K and 19,000 K and at pressures between 15 and 90 megabars. Expressions for the band structure energy of a randomly disordered alloy (including third order in the electron-ion interaction) are derived and evaluated. Short- and long-range orders are included by the quasi-chemical method, and lattice dynamics in the virtual-crystal harmonic approximation. Dissert. Abstr.

N78-17904 Utah Univ., Salt Lake City.
NEW NUCLEAR MAGNETIC RESONANCE TECHNIQUE FOR STUDYING DIFFUSION IN MULTI-SPIN CRYSTALS Ph.D. Thesis
Harold Taylor Stokes 1977 87 p
Avail: Univ. Microfilms Order No. 77-29465

The spin-lattice relaxation time of the spin order of secular dipolar interactions in the presence of a large RF field was measured in order to study slow atomic motions in multi-spin systems. By varying the frequency of the rf field, the effect of a particular spin species's motion on relaxation time relative to the other spin species is varied and thus the component motions are separated and identified. The general features of both spin-lattice relaxation time and the conventional dipolar spin-lattice relaxation time for the case of slow atomic motion in a multi-spin system were demonstrated in a single crystal of KF doped with

CaF2 where potassium vacancy diffusion is known to be dominant. Dissert. Abstr.

N78-17905# Oregon Graduate Center for Study and Research, Beaverton.
FIELD ELECTRON AND ION SOURCE RESEARCH FOR HIGH DENSITY INFORMATION STORAGE SYSTEM Interim Technical Report, 15 Aug. - 15 Nov. 1976
L. W. Swanson, A. E. Bell, J. Orloff, and G. A. Schwind May 1977 102 p refs
(Contract F33615-76-C-1327)
(AD-A048043; AFAL-TR-77-92; ITR-2) Avail: NTIS HC A06/MF A01 CSCL 20/3

The purpose of this research program is the development of high brightness field emission sources of both ions and electrons by use of field emission phenomena. In this report we concentrate on the liquid alloy (Ga/In (10%)) source. Both ion and electron emission results are reported along with analysis of the effect of various source configuration on its performance. The angular distribution has been measured for ion emission in a qualitative fashion and gives an angular intensity between 60 to 300 microns A/sr. The electron emission exhibits only a pulse mode of width approximately 10 nsec and amplitude approximately 100 A. A much larger angular distribution of the pulsed electron beam was observed in the electron mode. Author (GRA)

N78-17906# Army Electronics Command, Fort Monmouth, N. J. Electronics Technology and Devices Lab.
ELECTRON EMISSION FROM A THIN FILM IV-VI COMPOUND SEMICONDUCTOR
Bernard Smith and Harvey Weinstock Sep. 1977 38 p refs
(DA Proj. 1L7-62705-AH-94)
(AD-A047774; ECOM-4534) Avail: NTIS HC A03/MF A01 CSCL 20/12

The emission properties of thin film tin-oxide cold cathodes are reported. Indications of the relative effect of doping concentrations and thickness on emission properties are also included. Empirical analysis of the emission data is made and utilized to indicate the possible emission mechanism. Based on the results obtained during the course of this study, comments are given on this emitter's potential as a practical cold cathode for low and medium power microwave tubes. Author (GRA)

N78-17907# California Univ., La Jolla. Dept. of Physics.
INTERFACE ENERGIES Final Report, 31 Oct. 1976 - 1 Nov. 1977
Cheng-Chih Pei and Walter Kohn Nov. 1977 51 p refs
(Contract N00014-76-C-0050)
(AD-A048219; TR-43) Avail: NTIS HC A04/MF A01 CSCL 11/6

A practical scheme for the calculation of interface energies has been developed. It combines the theory of generalized Wannier functions, the generalized recursion method for calculating local densities of states and electronic density, and the local density functional theory. As a first application of this method we are calculating the stacking fault energy of nickel using tight binding type Wannier functions for the d-electrons and ignoring the effect of the s-electrons. The d band degeneracy is fully taken into account. The method also allows one to handle charge transfer effects: a stacking fault perturbation potential is included and calculated quasi-self-consistently. Comparison is made between the moment scheme, the non-self-consistent scheme and the self-consistent scheme. We find that the self-consistent scheme affects very little the stacking fault energy compared with the non-self-consistent scheme. GRA

N78-17908# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
MELT MOTION CAUSED BY THE DENSITY JUMP AT THE SOLIDIFICATION FRONT
S. I. Aladjev and A. S. Okhotin 1977 14 p refs
(PR-319) Avail: NTIS HC A02/MF A01

The melt motion caused by the density jump at the solidification front that occurs during growing single crystals was studied using the directional solidification method. The smallness of Reynolds numbers typical for the motion considered is the specific peculiarity for the operational conditions. Expressions are obtained for determining the pressure drop along the melt length in plane and cylindric crucibles necessary for the constant rate continuous solidification process being studied. The analysis performed indicates a close relation between the processes in the melt and the macrostructure of crystals formed. It is pointed out that the consideration of the motion associated with density jump is very important for obtaining more perfect single crystals. Author (ESA)

N78-17909# Technical Research Centre of Finland, Helsinki. Electron Physics lab.
APPLICABILITY OF THE SELF-CONSISTENT ORTHOGONALIZED-PLANE-WAVE METHOD TO THE ANISOTROPIC SEMICONDUCTORS TRIGONAL SELENIUM AND TITANIUM DISULPHIDE Ph.D. Thesis - Helsinki Univ. of Technol.
Juhani vonBoehm 9 Sep. 1975 29 p refs Sponsored by Ministry of Education and Found. for promotion of Technol.
(VTT-ENT-11; ISBN-951-38-0251-5) Avail: NTIS HC A03/MF A01

First the applicability of different self-consistent methods, especially of the self-consistent OPW (SCOPW) method, to the anisotropic semiconducting trigonal selenium and titanium disulfide crystals is briefly discussed. Then the physical approximations and convergence properties of the SCOPW method for selenium and titanium disulfide are considered from the numerical point of view. It is concluded that the effects of the physical approximations and the convergence properties of anisotropic crystals are rather similar to the cubic cases previously studied. Author (ESA)

N78-17910# Technical Research Centre of Finland, Helsinki. Semiconductor lab.
THEORY OF ANOMALOUS HALL EFFECT IN EUROPIUM CHALCOGENIDES Ph.D. Thesis - Helsinki Univ. of Technol.
J. Sinkkonen 10 Apr. 1976 78 p refs Sponsored by Found. for the Promotion of Technol. and Finn. Cultural Found.
(VTT-ENT-13; ISBN-951-38-0320-1) Avail: NTIS HC A05/MF A01

Considering the exchange interactions between the conduction electrons in a broad 5d-type band and the magnetic electrons in the localized 4f-shells, it is shown that in addition to the ordinary d-f exchange diagonal in band index, there is also a nondiagonal interaction representing a one particle transfer between the conduction and magnetic electrons. Including the spin-orbit coupling, an effective Hamiltonian for the conduction electrons is obtained, which contains additional asymmetric scattering terms. The ordinary d-f exchange is treated as the dominating scattering interaction. The anomalous Hall effect results by skew scattering and side jump mechanisms. The density matrix method is used to derive the transport properties. The effect of the correlation of spins at different lattice sites is discussed. The model indicates that the anomalous Hall effect can be seen in heavily doped samples. Author (ESA)

N78-17911# Technical Research Centre of Finland, Espoo. Semiconductor Lab.
JOSEPHSON TUNNEL JUNCTIONS ON NIOBIUM FILMS Ph.D. Thesis - Helsinki Univ. of Technol.
Tapio Wiik 17 Dec. 1976 33 p refs Sponsored by Finn. Cultural Found. and Wihuri Found.
(VTT-ENT-17; ISBN-951-38-0398-8) Avail: NTIS HC A03/MF A01

A method of fabricating stable Josephson tunnel junctions with reproducible characteristics is described. The junctions have a sandwich structure consisting of a vacuum evaporated niobium film, a niobium oxide layer produced by the glow discharge method, and a lead film deposited by vacuum evaporation. Difficulties in producing thin-film Josephson junctions are discussed. Experimental results suggest that the lower critical field of the niobium film is the most essential parameter when evaluating the quality of these junctions. The dependence of the lower critical field on the film thickness and on the Ginzburg-Landau parameter of the film is studied analytically. Comparison with the properties of the evaporated films and with the previous calculations for bulk specimens shows that the presented model is applicable for most of the prepared samples. Author (ESA)

N78-17112*# Massachusetts Inst. of Tech., Cambridge.
INTERFACE MARKING IN CRYSTALS: EXPERIMENT MA-060
H. C. Gatos, A. F. Witt, Lichtensteiger, and C. J. Herman *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 429-447 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 20B

N78-17114*# Rensselaer Polytechnic Inst., Troy, N. Y.
CRYSTAL GROWTH FROM THE VAPOR PHASE: EXPERIMENT MA-085
H. Wiedemeier, H. Sadeek, F. C. Klaessig, M. Norek, and R. Santandrea *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 471-490 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 20B

N78-17118*# Rockwell International Science Center, Thousand Oaks, Calif.
CRYSTAL GROWTH: EXPERIMENT MA-028
M. D. Lund *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 555-562 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 20B

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N78-17912 Harvard Univ., Cambridge, Mass.
MATHEMATICAL METHODS IN QUANTUM AND STATISTICAL MECHANICS Ph.D. Thesis
Louis Fishman 1977 391 p
Avail: Univ. Microfilms Order No. 77-29892

The J-matrix method, was extended to treat the script I to the th power partial wave kinetic energy and Coulomb Hamiltonians within the context of square integrable, Laguerre (Slater), and oscillator (Gaussian) basis sets. The determination of the expansion coefficients of the continuum eigenfunctions in terms of the L sub 2 basis set is shown to be equivalent to the solution of a linear second-order differential equation with appropriate boundary conditions, and complete solutions are presented. Physical scattering problems were approximated by a well-defined model which was then solved exactly. The appropriate formalism for treating many channel problems where target states of differing angular momentum were coupled was spelled out in detail. The method involved the evaluation of only L sub 2 matrix elements and finite matrix operations, yielding elastic and inelastic scattering information over a continuous range of energies. Dissert. Abstr.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N78-17913# Georgia Inst. of Tech., Atlanta. School of Information and Computer Science.
TOWARDS AN EMPIRICAL FOUNDATION OF MEANING Ph.D. Thesis
Charles Pearson Jun. 1977 581 p refs
(Grant NSF GN-40952)
(PB-273488/7; GIT-ICS-77-10) Avail: NTIS HC A25/MF A01 CSCL 05G

A language is developed, called the language of menetics, for analyzing meaning phenomena and the nature of meaning. The language of menetics includes a terminology, a semiotic point of view, a grammar for using the terminology with this point of view, a decision as to what kinds of problems are important for the study of meaning, what kinds of phenomena are important for understanding these problems, and what kinds of methods are useful for analyzing these phenomena for the purpose of solving the problems of choice. GRA

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N78-17914 Iowa State Univ. of Science and Technology, Ames.
WORK-IN-PROCESS INVENTORY AND PRODUCTION CAPACITY Ph.D. Thesis
Sung Ho Chung 1977 173 p
Avail: Univ. Microfilms Order No. 77-25977

In deterministic production system, which is one of the two hypothesized systems, the first objective is to derive a functional relationship between the Work-In-Process inventory and the parameters of the system. The second objective is to find an optimum solution. The deterministic production system is used as a vehicle to combine the decision on inventory, that on production scheduling and that on production capacity. In stochastic production system, which is the other of the two hypothesized systems, the first objective is to derive an empirical functional relationship between the production lead time of each part and the level of congestion in the production floor of the system. The second objective is to find the optimum level of congestion which minimizes the total cost which includes inventory holding cost and the cost associated with lowering the level of congestion. Dissert. Abstr.

N78-17915*# Gellman Research Associates, Inc., Jenkintown, Pa.
THE ROLE OF ENGINEERING IN THE FLIGHT EQUIPMENT PURCHASING PROCESS Final Report
Dec. 1977 85 p
(Contract NASw-3075)
(NASA-CR-156839) Avail: NTIS HC A05/MF A01 CSCL 05A

The role of the airline engineering department in the flight equipment acquisition process is examined. The data for the study was collected from six airlines. The principal findings of the study include: (1) engineering activities permeate, but do not dominate the airline flight equipment decision process. (2) The principal criterion for the flight equipment acquisition decision is return on investment. (3) The principal sources of information for the airline engineering departments in the monitoring process are the manufacturers of equipment. Subsidiary information sources include NASA publications and conferences, among others and (4) The engineering department is the principal communication channel for technical information. Author

N78-17916# Perceptronics, Inc., Woodland Hills, Calif.
AN INTERACTIVE COMPUTER AIDING SYSTEM FOR GROUP DECISION MAKING
Steven Johnston, Steven Levin, Judea Pearl, Marcy Agmon, and Antonio Leal Dec. 1977 87 p refs
(Contract MDA903-77-C-0184)
(AD-A047706; PQTR-1046-77-12) Avail: NTIS HC A05/MF A01 CSCL 05/8

This report describes a program centered on the demonstration of an interactive computer aid for group decision making. The report includes: (1) descriptions and theoretical bases for the system's principal decision analysis algorithms, (2) a report on the system software structure and major components, (3) scenario materials for evaluation studies, and (4) a comparison of the group aiding system to the SRI Decision Aiding Program. The next phase of the program will concentrate on operational testing and comparison of individual and group trees. Author (GRA)

N78-17917# Boeing Aerospace Co., Seattle, Wash. Logistics Support and Services.
HISTORICAL WEAPON SYSTEM RESOURCE UTILIZATION METHODOLOGY Final Report, Jun. 1976 - Jun. 1977
Frank D. Brown, Duncan L. Dieterly, Gary A. Walker, and David

H. Wilson Sep. 1977 79 p refs
(Contract F33615-76-C-0062)
(AD-A047885; AFHRL-TR-77-64(I)) Avail: NTIS MF A01 CSCL 12/2

This report presents recommended methods and practices to be considered for implementation during future Historical Weapon Systems Analysis efforts. Recommended methodology contained within this final report includes: 1. Contract performance planning 3. review of published literature 2. Documentation search and data acquisition techniques 4. Historical data analyses 5. task analyses of selected Air Force Specialties personnel Maintenance and operations and 6. life cycle costing. Recommendations contained within this final report are presented in functional/sequencial flow formats. They represent the results of lessons learned by investigators during their implementation of Phase I of Project 1959, VIZ C-130 E Historical Weapon System Analysis, encompassing 15 years 1962-1976. All methodologies, portrayed in functional flow sequences, are general in nature and encompass three tiers of logic i.e., zero indenture or top level, first indenture or second level, and second indenture or third level. Highlights of problem areas to be expected in future HWSA efforts are also presented. GRA

N78-17918# Decisions and Designs, Inc., McLean, Va.
A PROXY APPROACH TO MULTI-ATTRIBUTE DECISION MAKING Ph.D. Thesis
Kenneth R. Oppenheimer Oct. 1977 127 p refs Prepared in cooperation with Standard Univ., Calif.
(Contract N00014-76-C-0074; ARPA Order 3052)
(AD-A047900) Avail: NTIS HC A07/MF A01 CSCL 12/1

In many decision problems, the possible outcomes have several important dimensions of value. To identify the optimal alternative, the decision analyst must assess the decision maker's preferences over these multi-attribute outcomes. Two rival procedures for solving multi-attribute preference problems currently exist. These two procedures, global preference modeling and local preference modeling, each have advantages and disadvantages. This dissertation combines these two rival procedures in a new approach to multi-attribute decision making. This new combined method, called the proxy approach, uses the advantages of one technique to overcome the disadvantages of the other. GRA

N78-17919# RAND Corp., Santa Monica, Calif.
A DYNAMIC MODEL FOR OPTIMUM BONUS MANAGEMENT: COMPUTER PROGRAM AND MATHEMATICAL ANALYSIS Interim Report
Ray Danchick Oct. 1977 67 p
(Contract DAHC15-73-C-0181; ARPA Order 189)
(AD-A047983; RAND/R-1940/1-ARPA) Avail: NTIS HC A04/MF A01 CSCL 05/9

This report describes the mathematics and the computer program for solving the problem of optimum bonus management formulated in 'A Dynamic Model for Optimum Bonus Management'. The problem of optimum bonus management is treated as a discrete linear control system with a quadratic cost function and solved by using Pontryagin's discrete maximum principle. The state of the system at discrete time is a vector of numbers of men in each of a set of year groups. The system evolves linearly in time under linear controls that are the bonuses paid to the men in a prescribed subset of the year groups. The program solves for the sequence of bonus values that drive a given initial state of year groups to a prescribed final state and minimizes a sum of quadratic bonus and penalty costs. The program, which consists of a main program and 22 subroutines, is written in FORTRAN IV double precision for the IBM 370-158. GRA

N78-17920# International Institute for Applied Systems Analysis, Laxenburg (Austria).
APPLICATION OF A SIMPLE MULTIATTRIBUTE RATING TECHNIQUE TO EVALUATION OF NUCLEAR WASTE DISPOSAL SITES. A DEMONSTRATION
Harry J. Otway (IAEA) and Ward Edwards (Univ. of Southern Calif.) Jun. 1977 24 p refs
(IIASA-RM-77-31) Avail: NTIS HC A02/MF A01

Results of a decision exercise to evaluate six hypothetical sites for nuclear waste disposal are presented. The decision making group consisted of ten technical specialists who were attending an international meeting on this subject. Public attitudes toward the proposed sites were provided as one item of information. The suitability of alternative multiattribute rating techniques was explored; the participants chose a simplified method in preference to one based on hypothetical multidimensional gambles. The decision making group successfully used this simplified technique to aggregate technological and social issues in its decision. Author (ESA)

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N78-17921*+ National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BIBLIOGRAPHY OF LEWIS RESEARCH CENTER TECHNICAL CONTRIBUTIONS ANNOUNCED IN 1976
Dec. 1977 192 p
(NASA-TM-73860; E-9449) Avail: NTIS HC A09 CSCL 05B

Abstracts of Lewis authored publications and publications resulting from Lewis managed contracts which were announced in the 1976 issues of STAR (Scientific and Technical Aerospace Reports) and IAA (International Aerospace Abstracts) are presented. Research reports, journal articles, conference presentations, patents and patent applications, and these are included. The arrangement is by NASA subject category. Citations indicate report literature (identified by their N-numbers) and the journal and conference presentations (identified by their A-numbers). A grouping of indexes helps locate specific publications by author (including contractor authors), contractor organization, contract number, and report number. Author

N78-17922 Cornell Univ., New York.
THE SEMANTICS OF INFORMATION FLOW Ph.D. Thesis
Thomas Bennet London 1977 173 p
Avail: Univ. Microfilms Order No. 77-28368

A method of using information flow analysis to attack the confinement problem is described. Two equivalent information flow models are presented, a denotational model and a graph model, describing the potential of each statement of programing language for transmitting information. The denotational model associates a function with each statement of a program. Information flow functions are derived for such programing language constructs as iteration, procedures, and recursion. The graph model associates a graph with each statement of a program. Algorithms are developed that efficiently construct and analyze the graphs of various statement types. The run-time complexities of these algorithms are derived and compared. The description of information flow is utilized to obtain a confinement mechanism for determining whether a program should be executed. This mechanism is less restrictive than other compile-time approaches, and almost as tolerant as the best run-time monitor.
Dissert. Abstr.

N78-17923# Harbridge House, Inc., Chicago, Ill.
ALTERNATIVES FOR THE ANNUAL REPORT. THE FIVE YEAR OUTLOOK Final Report
Robert D. Crangle Jun. 1977 170 p
(Contract NSF C-973)
(PB-273390/5; OSTP-77/2) Avail: NTIS HC A08/MF A01 CSCL 05B

The results are given of an analysis of the Office of Science and Technology POLICY'S (OSTP) reporting requirements in the light of congressional hearings on the Act; interviews with various people; and a review of the format, preparation, and utilization of a multitude of existing federal reports. As a result of this analysis, four alternative conceptual approaches were identified for both the five year outlook and the annual report, and certain related selection criteria were identified. Each conceptual approach to an OSTP report is developed into a detailed production guide, and additional information on the availability of personnel and

other resources in the late 1970's was used to review the report format selection criteria as well as the report formats.
GRA

N78-17924# Futures Group, Gastonbury, Conn.
A DESIGN FOR THE PRESIDENT'S ANNUAL SCIENCE AND TECHNOLOGY REPORT AND FIVE-YEAR OUTLOOK. VOLUME 1: HANDBOOK OF OPERATIONS Final Report
Theodore J. Gordon Apr. 1977 38 p
(Contract NSF C-928)
(PB-273432/5; Rept-285-95-02/01; OSTP-77/1-1) Avail: NTIS HC A03/MF A01 CSCL 05B

The purpose of the study was to assist the Office in implementing the requirements of the National Science and Technology Policy, Organization and Priorities Act of 1976. These requirements entail an annual Science and Technology Report to the Congress and a Five-Year Outlook on scientific and technological events and issues relevant to the national interest. The Futures Group has identified conceptual frameworks and workable procedures for presenting the information requested by the Congress and has explored alternate methods for obtaining, organizing, and analyzing the data required by the reporting requirements. GRA

N78-17925# Futures Group, Gastonbury, Conn.
A DESIGN FOR THE PRESIDENT'S ANNUAL SCIENCE AND TECHNOLOGY REPORT AND FIVE-YEAR OUTLOOK. VOLUME 2: LEGISLATIVE INTENT AND AUDIENCE EXPECTATIONS FOR THE SCIENCE AND TECHNOLOGY REPORT AND OUTLOOK Final Report
Theodore J. Gordon Apr. 1977 134 p
(Contract NSF C-928)
(PB-273433/3; Rept-285-95-02-02; OSTP-77/1-2) Avail: NTIS HC A07/MF A01 CSCL 05B

The Office of Science and Technology Policy was assigned responsibility for performing forecasting functions and for developing annually a Five-Year Outlook on science and technology related issues affecting the nation. The study of the literature and Congressional hearings in Vol. 2 indicates that there would be serious political constraints on satisfying this requirement. The interviews confirmed the conclusions drawn from the literature. GRA

N78-17926# Futures Group, Gastonbury, Conn.
A DESIGN FOR THE PRESIDENT'S ANNUAL SCIENCE AND TECHNOLOGY REPORT AND FIVE-YEAR OUTLOOK. VOLUME 3: DESIGN AND PRODUCTION OF PRESIDENT'S REPORT
Theodore J. Gordon Apr. 1977 85 p
(Contract NSF C-928)
(PB-273434/1; Rept-285-95-02/03; OSTP-77/1-3) Avail: NTIS HC A05/MF A01 CSCL 05B

The criteria for constructing a science and technology report are reviewed and alternate frameworks for both reports are suggested. The organization and management necessary to produce the reports are studied, including the functions and information flow procedure of the Office of Science and Technology Policy. GRA

N78-17927# Naval Underwater Systems Center, New London, Conn. New London Lab.
SEQUENTIAL PARTITION DETECTORS WITH DEPENDENT SAMPLING
Roger F. Dwyer and Ludwik Kurz 17 Nov. 1977 22 p Presented at the IEEE Intern. Symp. on Inform. Theory, 1977
(AD-A047722; NUSC-TD-5815) Avail: NTIS HC A02/MF A01 CSCL 09/4

This document presents the oral version of a presentation given at the 1977 IEEE International Symposium on Information Theory, held at Cornell University, Ithaca, New York, 10-14 October. The paper is concerned with the effects of dependent sampling on sequential partition detectors. As stated in this document, sequential partition detectors show improved efficiency under dependent sampling. The text of this presentation will be available in the literature shortly. Author (GRA)

N78-17928# National Commission on New Technological Uses of Copyrighted Works, Washington, D. C.
TRANSCRIPT OF 16TH CONTU MEETING
Sep. 1977 365 p refs Meeting held at Chicago, 15-16 Sep. 1977
(PB-273594/2; CONTU-77-0010) Avail: NTIS HC A16/MF A01 CSCL 05B

Testimony given at public hearings on user needs and the implications of copyright law revisions for information systems having data bases and for industries using photocopying techniques or producing computers and photoreproduction equipment is presented. The development of a mechanism for paying royalties and the inpact of the law on computer software is also discussed. GRA

N78-17929# British Library Lending Div., Boston Spa (England).
THIRD EUROPEAN CONGRESS ON INFORMATION SYSTEMS AND NETWORKS: OVERCOMING THE LANGUAGE BARRIER
E. J. Coates Aug. 1977 23 p refs Conf. held at Luxemborg, 3-6 May 1977
(BLL-BLRDR-5380-(2113.56F)) Avail: British Library Lending Div., Boston Spa, Engl.

A plan of action for the improvement of the transfer of information between European countries and the multilingual problems in information storage and retrieval are considered. Topics discussed include: teaching and use of languages in the European Community; multilingual terminology; human and machine aided translation; multilingual thesauri; and automatic translation. J.M.S.

N78-17930# British Library Lending Div., Boston Spa (England).
ON-LINE INFORMATION RETRIEVAL. AN INTRODUCTION AND GUIDE TO THE BRITISH LIBRARY'S SHORT-TERM EXPERIMENTAL INFORMATION NETWORK PROJECT. VOLUME 1: EXPERIMENTAL USES OF NON-MEDICAL INFORMATION SERVICES
P. L. Holmes May 1977 70 p refs
(BLL-BLRDR-5360; ISBN-0-905984-02-1; ISSN-0308-2385) Avail: British Library Lending Div., Boston Spa, Engl: £5.00

Data was collected on the technical, economic, and user aspects of existing on-line bibliographic retrieval systems so that information workers could assess when, where, and how, or whether to, employ on-line services in the United Kingdom. Scientists, technologists, and information workers were given an opportunity to use a range of on-line information retrieval services and their reactions to these services were recorded and analyzed. A technical assessment was made of existing systems including hardware, software, and telecommunication facilities and operating costs were established. Emphasis was on the fields of computing and control engineering. P.R.A.

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N78-17931*# Summerfield Associates, Santa Monica, Calif.
DETERMINATION OF THE FLIGHT EQUIPMENT MAINTENANCE COSTS OF COMMUTER AIRLINES
Nov. 1977 37 p refs
(NASA Order A-36079-B(TS))
(NASA-CR-152069) Avail: NTIS HC A03/MF A01 CSCL 05C

Labor and materials costs associated with maintaining and operating 12 commuter airlines carrying an average of from 42 to 1,100 passengers daily in a variety of aircraft types were studied to determine the total direct maintenance cost per flight hour for the airframe, engine, and avionics and other instruments. The distribution of maintenance costs are analyzed for two carriers, one using turboprop aircraft and the other using piston engine aircraft. A.R.H.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N78-17932# Committee on Science and Technology (U. S. House).
NASA AUTHORIZATION, 1979, PROGRAM REVIEW, VOLUME 2, PART 1
Washington GPO 1977 431 p refs Hearings before the Subcomm. on Transportation, Aviation, and Weather of the Comm. on Sci. and Technol., 95th Congr., 1st Sess., No. 31, 20-21 Sep. 1977
(GPO-98-932) Avail: Subcomm. on Transportation, Aviation, and Weather

NASA programs in aeronautical research and development are described to justify budgetary requests for FY-1979. Included are statements regarding aircraft energy efficiency and technologies to reduce atmospheric pollution by aircraft. P.R.A.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N78-17933*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BASELINE TESTS OF THE AM GENERAL DJ-5E ELECTRUCK ELECTRIC DELIVERY VAN
Miles O. Dustin, Henry B. Tryon, and Noel B. Sargent Oct. 1977 45 p refs
(Contract EC-77-A-31-1011)
(NASA-TM-73758; E-9383; CONS/1011-3) Avail: NTIS HC A03/MF A01 CSCL 13F

An electric quarter ton truck designed for use as a postal delivery vehicle was tested to characterize the state of the art of electric vehicles. Vehicle performance test results are presented. It is powered by a single-module, 54 volt industrial battery through a silicon controlled rectifier continuously adjustable controller with regenerative braking applied to a direct current compound wound motor. Author

N78-17934*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BASELINE TESTS OF THE ZAGATO ELCAR ELECTRIC PASSENGER VEHICLE
Noel B. Sargent, Edward A. Maslowski, Ralph J. Slavick, and Richard F. Soltis Oct. 1977 36 p refs
(Contract EC-77-A-31-1011)
(NASA-TM-73764; CONS/1011-9; E-9442) Avail: NTIS HC A03/MF A01 CSCL 13F

The Elcar vehicle performance test results are presented. The Elcar Model 2000 is a two-passenger vehicle with a reinforced fiberglass body. It is powered by eight 12-volt batteries. The batteries are connected to the motor through an arrangement of contactors operated from a foot pedal in conjunction with a hand-operated switch. These contactors change the voltage applied to the 2-kilowatt motor. Acceleration tests, operating characteristics, and instrumentation are described. Author

N78-17935*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PHOTOVOLTAIC HIGHWAY APPLICATIONS: ASSESSMENT OF THE NEAR-TERM MARKET
Louis Rosenblum, Larry R. Scudder, William J. Bifano, and William A. Poley Dec. 1977 12 p ref
(Contract E(49-26)-1022)
(NASA-TM-73863; DOE/NASA/1022-77/22; E-9452) Avail: NTIS HC A02/MF A01 CSCL 05B

A preliminary assessment of the near-term market for photovoltaic highway applications is presented. Among the potential users, two market sectors are considered: government and commercial. Within these sectors, two possible application areas, signs and motorist aids, are discussed. Based on judgemental information, obtained by a brief survey of representatives of the two user sectors, the government sector appears more amenable to the introduction of photovoltaic power sources for highway applications in the near-term. However, considerable interest and potential opportunities were also found to exist in the commercial sector. Further studies to quantify the market for highway applications appear warranted. Author

N78-17936*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BASELINE TESTS OF THE POWER-TRAIN ELECTRIC DELIVERY VAN
Stacy Lumannick, Miles O. Dustin, and John M. Bozek Nov. 1977 60 p
(Contract EC-77-A-31-1011)
(NASA-TM-73765; E-9470; CONS/1011-10) Avail: NTIS HC A04/MF A01 CSCL 13F

Vehicle maximum speed, range at constant speed, range over stop-and-go driving schedules, maximum acceleration, gradeability, gradeability limit, road energy consumption, road power, indicated energy consumption, braking capability, battery charger efficiency, and battery characteristics were determined for a modified utility van powered by sixteen 6-volt batteries connected in series. A chopper controller actuated by a foot accelerator pedal changes the voltage applied to the 22- kilowatt (30-hp) series-wound drive motor. In addition to the conventional hydraulic braking system, the vehicle has hydraulic regenerative braking. Cycle tests and acceleration tests were conducted with and without hydraulic regeneration. Author

N78-17937*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TEST AND EVALUATION OF 23 ELECTRIC VEHICLES FOR STATE-OF-THE-ART ASSESSMENT
Miles O. Dustin and Robert J. Denington 3 Mar. 1978 24 p refs Presented at the 1978 SAE Congr., Detroit, Mich., 27 Feb. - 3 Mar. 1978
(Contract EC-77-A-31-1011)
(NASA-TM-73850; E-9438; CONS/1011-21) Avail: NTIS HC A02/MF A01 CSCL 13F

Eleven of the electric vehicles were passenger cars and 12 were commercial vans. Tests were conducted in accordance with an ERDS test procedure which is based on the SAE J227a Test Procedure. Tests included range, acceleration, coast-down, and braking. The results of the tests are presented, and comments on reliability are made. Author

N78-17938*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BASELINE TESTS OF THE EVA CHANGE-OF-PACE COUPE ELECTRIC PASSENGER VEHICLE
John M. Bozek, Edward A. Maslowski, and Miles O. Dustin Nov. 1977 63 p refs
(Contract EC-77-A-31-1011)
(NASA-TM-73763; E-9469; CONS/1011-8) Avail: NTIS HC A04/MF A01 CSCL 13F

The EVA Change-of-Pace Coupe, is an electric passenger vehicle, to characterize the state-of-the-art of electric vehicles. The EVA Change-of-Pace Coupe is a four passenger sedan that has been coverted to an electric vehicle. It is powered by twenty 6 volt traction batteries through a silicon controlled rectifier chopper controller actuated by a foot throttle to change the voltage applied to the series wound, direct current motor. Braking is accomplished with a vacuum assist hydraulic braking system. Regenerative braking is also provided. Author

N78-17939*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BASELINE TESTS OF THE EVA CONTRACTOR ELECTRIC PASSENGER VEHICLE
John M. Bozek, Henry B. Tryon, and Ralph J. Slavick Nov. 1977 57 p refs
(Contract EC-77-A-31-1011)

(NASA-TM-73762; E-9481; CONS/1011-7) Avail: NTIS HC A04/MF A01 CSCL 13F

The EVA Contactor four door sedan, an electric passenger vehicle, was tested to characterize the state-of-the-art of electric vehicles. It is a four passenger sedan that was converted to an electric vehicle. It is powered by 16 series connected 6 volt electric vehicle batteries through a four step contactor controller actuated by a foot accelerator pedal. The controller changes the voltage applied to the separately excited DC motor. The braking system is a vacuum assisted hydraulic braking system. Regenerative braking was also provided. Author

N78-17940*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

BASELINE TESTS OF THE BATTRONIC MINIVAN ELECTRIC DELIVERY VAN

Miles O. Dustin, Richard F. Soltis, John M. Bozek, and Edward A. Maslowski Dec. 1977 52 p refs

(Contract EC-77-A-31-1011)

(NASA-TM-73761; E-9483; CONS/1011-6) Avail: NTIS HC A04/MF A01 CSCL 13F

An electric passenger vehicle was tested to develop data characterizing the state of the art of electric and hybrid vehicles. The test measured vehicle maximum speed, range at constant speed, range over stop-and-go driving schedules, maximum acceleration, gradeability and limit, road energy consumption, road power, indicated energy consumption, braking capability and battery charge efficiency. The data obtained are to serve as a baseline to compare improvements in electric and hybrid vehicle technologies and to assist in establishing performance standards. G.Y.

N78-17941*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

MAKING AEROSPACE TECHNOLOGY WORK FOR THE AUTOMOTIVE INDUSTRY, INTRODUCTION

Walter T. Olson 1978 11 p Presented at the 1978 Congr. and Exposition of the Soc. of Automotive Engr., Detroit, 27 Feb. - 3 Mar. 1978

(NASA-TM-73870) Avail: NTIS HC A02/MF A01 CSCL 05A

NASA derived technology already in use in the automotive industry include: (1) developments in electronics design, computer systems, and quality control methods for line testing of cars and trucks; (2) a combustion analysis computer program for automotive engine research and development; (3) an infrared scanner and television display for analyzing tire design and performance, and for studying the effects of heat on the service life of V-belts, shock mounts, brakes, and rubber bearings; (4) exhaust gas analyzers for trouble shooting and emissions certification; (5) a device for reducing noise from trucks; and (6) a low cost test vehicle for measuring highway skid resistance. Services offered by NASA to facilitate access to its technology are described. Author

N78-17942*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

BASELINE TESTS OF THE C. H. WATERMAN DAF ELECTRIC PASSENGER VEHICLE

Noel B. Sargent, Edward A. Maslowski, Richard F. Soltis, and Richard M. Schuh Oct. 1977 113 p

(Contract EC-77-A-31-1011)

(NASA-TM-73757; CONS/1011-2; E-9388) Avail: NTIS HC A06/MF A01 CSCL 13F

An electric vehicle was tested as part of an Energy Research Development Administration (ERDA) project to characterize the state-of-the-art of electric vehicles. The Waterman vehicle performance test results are presented in this report. The vehicle is a converted four-passenger DAF 46 sedan. It is powered by sixteen 6-volt traction batteries through a three-step contactor controller actuated by a foot throttle to change the voltage applied to the 6.7 kW motor. The braking system is a conventional hydraulic braking system. Author

N78-17943# Defense Systems Management School, Fort Belvoir, Va.

THE PROBLEM OF TECHNOLOGY TRANSFER: REAL OR IMAGINED

Warren W. Cook May 1977 52 p refs

(AD-A042961) Avail: NTIS HC A04/MF A01 CSCL 05/1

This study project report provides an analysis of the process by which the Air Force transfers or transitions technology from less than major system advanced development projects performed in Air Force laboratories to use in operational systems. An examination of the DoD and Military Departments policies, procedures and technology base management techniques lead to a description of the factors that tend to camouflage or provide roadblocks to the transition process. These factors are placed into Communications/Motivation Groups and are evaluated for their impact on the process. Conclusions are reached concerning the Air Force laboratory organizational structure, use of off-the-shelf hardware, contractor independent research and development, and contract procedures. Recommendations discuss documentation, changes in organizational structure, and modification of procurement and contracting procedures. Author (GRA)

N78-17944# Denver Federal Executive Board, Colo. Committee on Energy and Environment.

CONFERENCE PROCEEDINGS: A CRITICAL ECONOMIC BALANCE: WATER, LAND, ENERGY, PEOPLE

Final Report

Polly Garrett, ed. (Federal Energy Administration), Glenn Kissinger, ed. (Colorado Dept. of Local Affairs), and Joe Newlin, ed. (Colorado State Univ.) Jun. 1977 122 p Proc. held at Pingree Park, Colo., 6-7 Jun. 1977 Sponsored by FEA, and Colorado State Rural Development Committee

(PB-274089/2; FEA-77-8-6) Avail: NTIS HC A06/MF A01 CSCL 13B

Objectives of the conference were to: encourage regional coordination in the delivery of services and programs which deal with water, energy, land, and population growth; stimulate participants to think critically and creatively about present and future issues, responsibilities and directions for effective economic planning; develop, based on the collective best thinking of the participants, contemporary statements concerning possible actions to be taken by decision makers in government, business, industry, and the public in effecting an economic balance in the region (and in the nation). GRA

N78-17945# Rutgers - The State Univ., New Brunswick, N. J. Water Resources Research Inst.

ADVANTAGES AND DISADVANTAGES OF REGIONAL SEWERAGE SYSTEMS

William Whipple, Jr. Nov. 1977 21 p refs Presented at Ann. Meeting of Am. Water Resources Assoc., 13th, Tucson, Ariz., 31 Oct. - 3 Nov. 1977

(Contract DI-14-34-0001-8032)

(PB-273826/8; W78-00562; OWRT-A-048-NJ(2)) Avail: NTIS HC A02/MF A01 CSCL 13B

A few years ago, many water quality administrators were convinced that large regional sewerage systems, consisting of one large treatment plant and long trunk sewer extending out to various communities, represented the only efficient and economical means of assuring water quality control. In parts of New Jersey strong environmental and community resistance has arisen to proposed central plant trunk sewer systems. The facilitating of new development along the trunk sewer is viewed as a menace by townships which do not want intensive development of these areas. The diversion of effluent flows to trunk sewers rather than septic tanks would dry up the streams which water quality programs are supposed to protect. GRA

N78-17946# South Florida Regional Planning Council, Miami.

DEVELOPMENT SUITABILITY METHODOLOGY

Final Report

Jun. 1977 99 p refs

(Grant HUD-CPA-FL-1007)

(PB-273642/9; SFRPC-502-03-01-77) Avail: NTIS HC A05/MF A01 CSCL 13B

The development suitability methodology model enables a user to evaluate the current ability of an area to support various types of development based on existing natural and man made constraints, as well as the projected capacity of an area as determined by resources (natural or built) already committed to future development. The use of decision logic techniques which are external to the data management process allows the model to accommodate changes in data values. The model uses as

input various data including land use, environmental, demographics, and public facilities. The results serve as a basis for testing alternating growth management strategies from a physical perspective and provide fundamental information for developing and testing growth management policies. GRA

N78-17947# Citizen Involvement Network, Washington, D. C.
A GUIDE TO CITIZEN-BASED PLANNING FOR SUBURBS, SMALL CITIES AND TOWNS Final Report
David Goldberg, Lawrence Susskind, and John Briggs Jul. 1977 56 p refs
(Contract HUD-H-2556)
(PB-273625/4; HUD/RES-1169) Avail: NTIS HC A04/MF A01 CSCL 13B

The guide describes the steps involved in citizen-based, comprehensive, community planning, viz. the involvement of the largest and most broadly representative sample possible of the population in charting the future course of the community. The method is most appropriate in relatively homogeneous communities and for communities which can draw on significant university or professional assistance in the design and implementation of the citizen planning process. It includes a case history and a catalog of resources available to assist citizen groups. GRA

N78-17948# Godschalk (David R.), Chapel Hill, N. C.
CARRYING CAPACITY APPLICATIONS IN GROWTH MANAGEMENT: A RECONNAISSANCE Final Report
David R. Godschalk and Norman Axler Jul. 1977 180 p refs
(Contract HUD-829-77)
(PB-273494/5; HUD/RES-1166) Avail: NTIS HC A09/MF A01 CSCL 13B

A review of 28 recent plans and studies is given using the concept of carrying capacity in growth management at the state, regional, or local level. A relevant application is defined as one that looks at effects of urban development upon the natural and man made environments in terms of system effects, and one that recognizes the possibility for governmental action to effect system capacity in terms of thresholds of development. Carrying capacity is viewed as a way of framing relationship between growth, environmental quality, public policy, and investment in infrastructure. The discussion investigates background and evolution of carrying capacity, compares methods and content of current applications, presents conclusions on the state of the art, and makes recommendations for further development of carrying capacity planning. Also given are a bibliography of carrying capacity reports and a summary of a 1977 workshop held to discuss the report findings. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N78-17949 Washington Univ., St. Louis, Mo.
OPTICAL CLUES TO THE NATURE OF HERCULES X-1/HZ HERCULES Ph.D. Thesis
Donald James Gerend 1977 198 p
Avail: Univ. Microfilms Order No. 77-26826

The X-ray binary HZ Her/Her X-1 was the object of an 85 night observational study using standard UBVr photometry. Early results revealed a strong correlation between the morphological and color changes of the 1.7 day orbital light curve and the 35 deg X-ray flux cycle. The regular occurrence of a well-defined secondary minimum during part of the 35 deg cycle, and the predictable progression towards earlier orbital phase of large-amplitude bright features, strongly suggested a geometrical interpretation for the optical behavior of this source. The power spectrum of the composite data set revealed the remarkable fact that virtually all power is concentrated at the discrete frequencies nu sub 1.7 and sums of harmonics of nu sub 1.7 and nu sub 3.5. This, in addition to the light curve evolution repeatability and symmetry properties suggested that the HZ Her/Her X-1 system was amenable to detailed model analysis. Photometric observations were also obtained for two other optical counterparts to X-ray sources, X Per (3U 0352+30) and HDE 226868 (Cyg X-1). Dissert. Abstr.

N78-17950 Stanford Univ., Calif.
THE THEORY AND IMPLEMENTATION OF THE STANFORD APERTURE SYNTHESIS RADIO TELESCOPE; AND OBSERVATIONS OF THE SOLAR SLOWLY VARYING COMPONENT AT A WAVELENGTH OF 2.8 CENTIMETERS Ph.D. Thesis
Clifford John Grebenkemper 1977 170 p
Avail: Univ. Microfilms Order No. 77-25674

The Stanford five-element interferometer was used to make brightness temperature and polarization measurements of solar active regions. The gyro-resonance model proposes that the emission originates from thermal electrons located in layers in which the emission frequency is a harmonic of the electron gyro-frequency. The output of the interferometer was derived for a collection of plane waves arriving at the antennas. A method for estimating the original brightness distribution using an error-tolerant maximum entropy algorithm which is applicable to circularly polarized data was discussed. The conversion from heliocentric to equatorial coordinates was derived. Dissert. Abstr.

N78-17951 Princeton Univ., N. J.
OPTICAL PULSATION FROM THE HZ Her/Her X-1 SYSTEM Ph.D. Thesis
Thomas Jay Chester 1977 127 p
Avail: Univ. Microfilms Order No. 77-28117

A theoretical model for the observed optical pulsation from the X-ray binary HZ Her/Her X-1 is presented. Its foundation is a general computer code for a X-ray illuminated stellar atmosphere. Detailed results are given for several atmospheres applicable to HZ Her. A formalism was developed to calculate the amount of pulsed optical radiation emergent from these atmospheres if they are exposed to pulsed X-rays. This formalism was used to calculate the pulsed and unpulsed optical light curves for HZ Her. The calculated optical pulsation agrees with the observed amplitude. Dissert. Abstr.

N78-17952 Iowa Univ., Iowa City.
COMPARISON OF bvri OBSERVATIONS OF BY DRACONIS WITH THE SPOT MODEL Ph.D. Thesis
Jeffrey Kent Davidson 1977 99 p
Avail: Univ. Microfilms Order No. 77-28443

Filter photometry of the spectroscopic binary and flare star BY Draconis was obtained at wavelengths between 4650 A and 8150 A. The infrared observations were specifically obtained in order to test the validity of a spot model, proposed to explain the small amplitude periodic light variability of BY Draconis and other dMe stars. These observations are in agreement with either a spot on the primary star approximately 200 K cooler than the photosphere covering 8 percent of the star's surface and extending 200 deg in longitude or by a spot on the secondary star approximately 250 K hotter than the photosphere and extending 140 deg in longitude. Dissert. Abstr.

N78-17953 Cornell Univ., Ithaca, N. Y.
LOW ENERGY GAMMA RAY ASTRONOMY FROM APOLLO 16 Ph.D. Thesis
David Arnold Gilman 1977 129 p
Avail: Univ. Microfilms Order No. 77-28352

Significant variations in the 72 to 200 kilo electron volts gamma ray energy interval were recorded, providing a unique data base for very low energy gamma ray astronomy. Interpretation of the variation observed in terms of sources in the gamma ray sky was studied. The method of data analysis extend the procedures used in hard X-ray and soft gamma ray astronomy to the case of an extremely large field of view. Exposures were calculated for both point sources and extended sources. A system of equations was established which expresses the counting rate as the sum of the strength of the sources weighted by the

exposure. This system was inverted by a weighted-least-squares procedure to determine the source fluxes from the observed counting rates. Dissert. Abstr.

N78-17954 Virginia Univ., Charlottesville.
EFFECTS OF NONUNIFORM STRUCTURE IN COMPACT SYNCHROTRON SOURCES Ph.D. Thesis
Alan Patrick Marscher 1977 85 p
Avail: Univ. Microfilms Order No. 77-28617

The manner in which gradients in the magnetic field and relativistic electron distribution affect the spectra and time development of synchrotron radiation from compact sources was investigated. Analytic expressions for the frequency spectrum in the quasistatic limit were found. The dependence of the characteristic size of the source on frequency was derived. How the important physical parameters of a nonuniform source can be directly derived from observable quantities was discussed. The results indicate that the existence of gradients in the magnetic field and the distribution of relativistic electrons cannot by themselves substantially alleviate the energy and inverse Compton difficulties of some compact sources. Dissert. Abstr.

N78-17955 Princeton Univ., N. J.
THE DISTRIBUTION OF GALAXIES AROUND RICH CLUSTERS AND THE CLUSTERING OF RADIO SOURCES Ph.D. Thesis
Michael Seldner 1977 191 p
Avail: Univ. Microfilms Order No. 77-28136

The distributions of two different sets of extragalactic objects were examined using the correlation function technique. A model for the halo of galaxies around a rich cluster was constructed to fit the observed angular cross-correlation of the Abell and Shane-Wirtanen catalogs. The distance dependence of the correlation functions is computed, giving a test of the galaxy luminosity function. Estimates of the richness - magnitude correlation are obtained. The 4C catalog of radio sources was examined for the presence of clustering. A strong correlation is found between the sources and optical galaxies. Evaluation of the auto-correlation function reveals that the sources themselves are clustered. A radio luminosity function consistent with the source counts is used to determine the spatial correlation functions. A simple model is presented to explain the relative amplitudes of the galaxy-galaxy, galaxy-source, and source-source correlation functions. Dissert. Abstr.

N78-17956*# Cornell Univ., Ithaca, N. Y. Center for Radiophysics and Space Research.
A MULTI-BAND FAR-INFRARED SURVEY WITH A BALLOON-BORNE TELESCOPE. FAR-INFRARED PHOTOMETRY WITH AN 0.4 METER LIQUID HELIUM COOLED BALLOON-BORNE TELESCOPE Final Report, 20 Nov. 1972 - 19 Feb. 1978. Ph.D. Thesis
Michael Ray Jacobson, Martin Harwit, Carlton Frederick, Dennis B. Ward, Gary Melnick, and G. Stasavage 19 Feb. 1978 268 p refs
(Grant NGR-33-010-172)
(NASA-CR-155737; CRSR-685; CRSR-673) Avail: NTIS HC A12/MF A01 CSCL 03A

Nine additional radiation sources, above a 3-sigma confidence level of 1300 Jy, were identified at 100 microns by far infrared photometry of the galactic plane using a 0.4 meter aperture, liquid helium cooled, multichannel far infrared balloon-borne telescope. The instrument is described, including its electronics, pointing and suspension systems, and ground support equipment. Testing procedures and flight staging are discussed along with the reduction and analysis of the data acquired. The history of infrared astronomy is reviewed. General infrared techniques and the concerns of balloon astronomers are explored. A.R.H.

N78-17957*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
S201 CATALOG OF FAR-ULTRAVIOLET OBJECTS Final Report
Thornton Page, George K. Carruthers (NRL), and Richard E. Hill (Lockheed Electronics Co.) 20 Jan. 1978 164 p refs
(NASA-TM-79343; NRL-8173) Avail: NTIS HC A08/MF A01 CSCL 03A

A catalog of star images was compiled from images obtained by an NRL Far-Ultraviolet Camera/Spectrograph operated from 21 to 23 April 1972 on the lunar surface during the Apollo-16 mission. These images were scanned on a microdensitometer, and the output recorded on magnetic tapes. The catalog is divided into 11 parts, covering ten fields in the sky (the Sagittarius field being covered by two parts), and each part is headed by a constellation name and the field center coordinates. The errors in position of the detected images are less than about 3 arc-min. Correlations are given with star numbers in the Smithsonian Astrophysical Observatory catalog. Values are given of the peak density and the density volume. The text includes a discussion of the photometry, corrections thereto due to threshold and saturation effects, and its comparison with theoretical expectation, stellar model atmospheres, and a generalized far-ultraviolet interstellar extinction law. The S201 catalog is also available on a single reel of seven-track magnetic tape. Author

N78-17958*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EXTENDED OBSERVATIONS OF VELA X-1 BY OSO-8
R. H. Becker, R. E. Rothschild, E. A. Boldt, S. S. Holt, S. H. Pravdo, P. J. Serlemitsos, and J. H. Swank Oct. 1977 19 p refs Submitted for publication
(NASA-TM-78098) Avail: NTIS HC A02/MF A01 CSCL 03A

The Goddard Space Flight Center Cosmic X-Ray Experiment aboard OSO-8 viewed the X-ray binary pulsar, Vela X-1, on three occasions from late 1975 through late 1976. The X-ray spectrum is well represented by a power law modified by photoelectric absorption, a high energy cutoff, and a line feature at approximately 6.8 keV. When combined with other observations, our measurements show that the pulse period is not decreasing monotonically. The three eclipses observed all indicate a significant eclipse flux. Author

N78-17959# Naval Intelligence Support Center, Washington, D. C. Translation Div.
STRUCTURE OF THE ASTEROID BELT
G. A. Chebotarev and V. A. Shor 22 Aug. 1977 50 p refs Transl. into ENGLISH from Inst. of Theoret. Astronomy, Trans. (USSR), no. 15, 1976 p 60-90
(AD-A044296; NISC-Trans-3957) Avail: NTIS HC A03/MF A01 CSCL 03/1

This paper reviews the present-day data on the spacial distribution of orbits and the motion of characteristic objects in the asteroid belt. The distribution of asteroids as a function of their stellar magnitudes, radii, and masses is also considered. Particular attention is devoted to the influence of the selection effects on the statistics and to the explanation of the characteristics of the distribution in terms of the gravitational theory and collisional fragmentation of bodies. This paper contains original data in the form of tables and graphs and an extensive bibliography. GRA

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N78-17960 Colorado Univ., Boulder.
RADIATIVELY-DRIVEN STELLAR WINDS Ph.D. Thesis
David Charles Abbott 1977 213 p
Avail: Univ. Microfilms Order No. 77-29893

An attempt is made to show that the large mass outflows observed in highly luminous stars results from the force of radiation pressure. To calculate this force, it was necessary to compute and/or compile oscillator strengths from ions in the third to sixth stage of ionization of the 21 elements of greatest cosmic abundance. The hydrodynamic equations were solved using this calculated force, and the resultant model agrees with observation to within the accuracy of the calculations. The main properties of the stellar wind are: (1) the rate of mass loss is proportional to the luminosity, and (2) the terminal velocity scales with the photospheric escape velocity, (3) the density structure is of the core/halo type, and (4) the properties of the envelope will be very sensitive to any gradients in the radiation force.
Dissert. Abstr.

N78-17961 Maryland Univ., College Park.
THE GALACTIC DISTRIBUTIONS AND KINEMATICS OF THE UNIDENTIFIED TYPE II OH/IR STARS Ph.D. Thesis
Phillip Frederick Bowers 1977 188 p
Avail: Univ. Microfilms Order No. 77-29143

The results of a large-scale OH sky survey at 1612 MHz are presented. The survey was designed to detect OH maser emission of the type commonly associated with late-type stars in order to study the galactic distribution and kinematics of these objects at large distances from the sun. A large range in galactic longitude, galactic latitude, and velocity were observed. Approximately 40 previously unknown sources were discovered, and the majority of these had OH characteristics similar to those for late-type (OH/IR) stars. Few bright unidentified OH/IR stars are shown to exist outside the solar circle. The number of sources increases for script l < or approximately 50 deg with an abrupt increase at script l approximately equal to 30 deg and a monotonic decrease for script l < 30 deg. The spatial density distribution was derived by modelling the galaxy as a set of independent rings at various galactocentric radii with finite widths in the z direction (perpendicular to the galactic plane). Dissert. Abstr.

N78-17962 Texas Univ., Austin.
FAMILIES OF PERIODIC ORBITS IN THE PLANAR PROBLEM OF THREE BODIES Ph.D. Thesis
Joan Bixby Dunham 1977 215 p
Avail: Univ. Microfilms Order No. 77-29023

The linear stability of families was examined using the variational equations in both heliocentric and Jacobian coordinate systems. Stable and unstable orbits were found as the ratio of the masses goes from the restricted problem to the equal mass case. Stability of orbits having close approaches or collisions was examined. A parameter that is the product of the square of the angular momentum and the total energy was computed for orbits in each family. This parameter was compared to the critical values obtained from the zero velocity surfaces of the planar problem of three bodies to obtain a measure of stability. The orbits are computed with a Runge-Kutta-Fehlberg numerical integrator using the regularization method of Levi-Civita.
Dissert. Abstr.

N78-17963 Iowa Univ., Iowa City.
LUMINOSITY CONSTANT MODELS OF CIRCUMSTELLAR DUST SHELLS AND RESULTANT SPECTRA Ph.D. Thesis
John Douglas Menietti 1977 75 p
Avail: Univ. Microfilms Order No. 77-28490

Equations are presented which describe mass flow in a stellar atmosphere in which radiation pressure is important. The stellar gas, which contains condensable material, is accelerated outward by radiation. Particles condensing from the gas then form a circumstellar shell which is a source of 10 micron infrared radiation. The equations are solved numerically to produce models of M-type giant stars which contain condensable silicates. An iterative technique, which includes solution of the radiative transfer problem, results in theoretical spectra of six models which are examined for general conclusions regarding mass loss rates, 10 micron emission, and water vapor absorption bands.
Dissert. Abstr.

N78-17964*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETIC FIELDS AND FLOWS BETWEEN 1 AU AND 0.3 AU DURING THE PRIMARY MISSION OF HELIOS 1
L. F. Burlaga, N. F. Ness, F. Mariani (Rome Univ.), B. Bavassano (cnr, Frascati, Italy), U. Villante (Aquila Univ.), H. Rosenbauer (Max-Planck-Inst. fuer Aeronomie), R. Schwenn (Max-Planck-Inst. fuer Physik und Astrophys., Munich, West Germany), and J. Harvey (Kitt Peak National Observation) Jan. 1978 41 p refs Sumbitted for Publication
(NASA-TM-78074) Avail: NTIS HC A03/MF A01 CSCL 03B

The recurrent flow and field patterns observed by HELIOS 1, and the relation between these patterns and coronal holes are discussed. Four types of recurrent patterns were observed: a large recurrent stream, a recurrent slow (quiet) flow, a rapidly evolving flow, and a recurrent compound stream. There recurrent streams were not stationary, for although the sources recurred at approximately the same longitudes on successive rotations, the shapes and latitudinal patterns changed from one rotation to the next. A type of magnetic field and plasma structure characterized by a low ion temperature and a high magnetic field intensity is described as well as the structures of stream boundaries between the sun at approximately 0.3 AU. Author

N78-17965*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GALACTIC DISTRIBUTION OF CARBON MONOXIDE: AN OUT-OF-PLANE SURVEY Ph.D. Thesis
Richard Stuart Cohen Jan. 1978 137 p refs
(NASA-TM-78071) Avail: NTIS HC A07/MF A01 CSCL 03B

Galactic CO line emission at 115 GHz has been surveyed. This survey confirms the finding that CO is concentrated in a ring. It provides a determination of the thickness of this molecular ring as a function of galactic radius and shows that CO is displaced from the conventional galactic plane. These results were arrived at by least-squares fitting the survey data to a circularly symmetric model of the Galaxy. A comparison of the CO and HI distributions shows that there are marked differences in the distributions of these species, both radially and out of the plane. A detailed discussion of the antenna characteristics, including the radiation pattern and pointing characteristics is presented. Author

N78-17966# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
A NUMERICAL MODEL OF THE MOON'S ROTATION Interim Report
Roger Cappallo, Charles C. Counselman, III, Irwin I. Shapiro (AFSC), and Robert W. King 25 Jul. 1977 33 p refs
(Contract F19628-75-C-0058)
(AD-A045591; Scientific-2; AFGL-TR-77-0178) Avail: NTIS HC A03/MF A01 CSCL 03/1

The differential equations for the Moon's rotation are derived in terms of Euler angles referenced to an inertial coordinate system. Also, the variational equations of the rotation with respect to six Euler angle initial conditions, the lunar J sub 2, the moment-of-inertia ratios Beta and Gamma, and the coefficients of the third and higher-degree gravity harmonics, are presented in detail. The equations of motion were integrated numerically within the framework of MIT's Planetary Ephemeris Program, and the initial conditions were adjusted to fit the libration angles given by the numerical LLB-5 model of J.G. Williams and others at JPL. The postfit rms orientation difference, after removal of a three-axis rotation to correct for lunar orbital ephemeris differences, was about 0.03 arcsec (selenocentric) over a six-year span. Neglected effects and anticipated improvements in our model are also discussed. GRA

N78-17967# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
MAGNETIC RECONNECTION IN A SPACE PLASMA
A. A. Galeev and L. M. Zeleny 1977 42 p refs
(D-249) Avail: NTIS HC A03/MF A01

A review of the collisionless magnetic field lines reconnection in space plasma is presented with special regard to the earth's magnetosphere. The collisionless testing mode is considered the main mechanism for magnetic field lines merging. It is shown that the difference between the nose and tail reconnection is related to the difference in magnetic field line geometries. Nonlinear analysis of the collisionless tearing mode provides an estimate of the interplanetary and geomagnetic field lines reconnection rate. Magnetospheric tail instability during substorms is discussed in terms of the tearing-mode development.
Author (ESA)

N78-17968# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
ON THE IMPORTANCE OF PLASMA EFFECTS FOR ORIGIN OF HIGH-VELOCITY SPECTRAL STRUCTURES IN THE GALACTIC MASERS
V. V. Burdjuzha, V. M. Charugin, and V. M. Tomosov 1977 20 p refs
(PR-334) Avail: NTIS HC A02/MF A01

The importance of plasma effects in maser sources is discussed. The possibility of occurrence of the radiation satellites omega o + or - e in OH and H2O masers is treated. The satellites result from maser radiation interaction with turbulent

plasma due to merging and decay processes. Cosmic plasma can be diagnosed by means of the observed symmetric structures in the radial velocities from H2O maser sources. An explanation is offered as to the advantageous location of maser structures at negative velocities relative to those which characterize the compact zone H III. The super high velocity structures can be available in spectrum of H2O molecule radiation from IR stars of NML Cyg. VYCMa. et al. types. Author (ESA)

N78-17093*# California Univ., Berkeley.
INTERSTELLAR HELIUM GLOW: EXPERIMENT MA-088
S. Bowyer, J. Freeman, M. Lampton, and F. Paresce *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 71-83 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 03B

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N78-17969 Colorado Univ., Boulder.
DESCRIPTION OF THE VERTICAL DISTRIBUTION OF OZONE IN THE MARTIAN ATMOSPHERE FROM MARINER 9 ULTRAVIOLET SPECTROMETER DATA Ph.D. Thesis
William Mead Wehrbein 1977 192 p
Avail: Univ. Microfilms Order No. 77-29986

The vertical distribution of ozone in the atmosphere of Mars was computed from ultraviolet spectra obtained by the Mariner 9 spacecraft. In the Northern Hemisphere the ozone scale height is smaller than the atmospheric scale height in midlatitudes and increases rapidly to a maximum farther north. Ozone amounts in the Southern Hemisphere are so small that the relation between scale height and latitude cannot be determined. At high latitudes (above 60 degrees) there is no significant difference between the scale heights of ozone in the Northern Hemisphere and the Southern Hemisphere. The column abundance of ozone also depends on latitude. Comparison of the ozone distribution with atmospheric temperature structure indicates that at some locations in the North, the density of water vapor must increase with altitude and the eddy diffusion coefficient is less than 4 x 10 to the 6th power sq cm per sec. Dissert. Abstr.

N78-17970 Texas Univ., Austin.
MAGNESIUM ISOTOPIC STUDIES OF ALLENDE INCLUSIONS Ph.D. Thesis
Typhoon Lee 1977 222 p
Avail: Univ. Microfilms Order No. 77-29060

Mg isotopic abundance variations in primitive inclusions of the Allende meteorite and their constituent mineral phases were studied. Large Mg-26 excesses of up to 10% were found which correlate with the Al-27/Mg-24 of the coexisting phases in the same inclusion. This correlation strongly indicates that these excesses were due to the decay of Al-26 in these inclusions. Since the Ca isotopic composition of samples showing large Mg-26 excess is found to be solar, the Allende inclusions are probably ordinary solar system objects. The evidence for Al-26 in Allende thus implies that this presently extinct nuclide was present in the early solar system. This result requires that either a supernova injected material into the solar system within 3,000,000 years of the onset of condensation in the solar system or there was an epoch of intense irradiation of the solar nebula by energetic protons from the primeval sun. Dissert. Abstr.

N78-17971* National Aeronautics and Space Administration, Washington, D. C.
A POSSIBLE EXPLANATION OF THE MECHANISM OF FORMATION OF THE EQUATORIAL JET ON THE SURFACE OF JUPITER
I. M. Yavorskaya and L. M. Simuni Dec. 1977 10 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (USSR), v. 233, no. 1, 1977 p 60-63 Original language document was announced as A78-15534 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. Prep. by Academy of Sciences (USSR), Leningrad
(Contract NASw-2790)
(NASA-TM-75247) Copyright. Avail: Issuing Activity CSCL 03B

Formation of the equatorial jet of the Jovian surface was explained as a consequence of the Taylor-Proudman theorem. The asymptotic theory of motion of low viscosity fluids in a rotating spherical shear layer was included. The model shows the straited structure of the Jovian surface as the outflow of convective cells having the shape of axisymmetric rolls extended along the axis of rotation in the meridional direction. Depth of the layer was found to be of the order of 1000 kilometers.
Author

N78-17972*# Stanford Univ., Calif. Center for Radar Astronomy.
COMPARISON OF QUASI-SPECULAR RADAR SCATTER FROM THE MOON WITH SURFACE PARAMETERS OBTAINED FROM IMAGES
G. Leonard Tyler 9 Jan. 1978 53 p refs
(Grant NsG-7029)
(NASA-CR-155713) Avail: NTIS HC A04/MF A01 CSCL 03B

Quasi-specular radar scatter from geologic surfaces displays a variable wavelength dependence in apparent surface roughness. Wavelength dependence will occur whenever a significant fraction of the surface has local radii of curvature comparable to the observing wavelength. This condition can be determined by comparison of the value of the integrated surface curvature spectrum with the radar wavenumber, multiplied by a constant that depends on the geometry. Variations in curvature statistics calculated from photogrammetric reduction of lunar images are consistent with the observed variations in quasi-specular scatter at the same locations. Variations in the strength of the wavelength dependence are correlated with the sizes of lunar craters that lie near the upper size limit for the local steady state distribution. This correlation is also consistent with variations in the curvature spectrum calculated from crater size-frequency distributions.
Author

N78-17973*# Little (Arthur D.), Inc., Cambridge, Mass.
INFRARED SPECTRA OF LUNAR SOILS Annual Progress Report, 1 Jul. 1977 - 1 Jan. 1978
J. R. Aronson, E. M. Smith, and P. C. VonThuna 1 Jan. 1978 7 p refs
(Contract NAS9-15356)
(NASA-CR-151629) Avail: NTIS HC A02/MF A01 CSCL 03B

Lunar sample measurements were made both under ambient nitrogen pressure and under vacuum conditions. Average emittance values were analyzed for a number of samples which were determined to include silicate minerals, pyroxenes, and fine particle feldspar. Information is also provided on modifications made to emittance apparatus in order to work with smaller sample sizes and to prevent accidental loss or contamination of the lunar sample material. B.L.P.

N78-17974*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO-11 LUNAR SAMPLE INFORMATION CATALOGUE
F. E. Kramer, comp., D. B. Twedell, comp., and W. J. A. Walton, Jr., comp. Feb. 1977 478 p refs Revised
(NASA-TM-79344; JSC-12522-Rev) Avail: NTIS HC A21/MF A01 CSCL 03B

The Apollo 11 mission is reviewed with emphasis on the collection of lunar samples, their geologic setting, early processing, and preliminary examination. The experience gained during five subsequent missions was applied to obtain physical-chemical data for each sample using photographic and binocular microscope techniques. Topics discussed include: binocular examination procedure; breccia clast descriptions, thin section examinations procedure typical breccia in thin section, typical basalt in thin section, sample histories, and chemical and age data. An index to photographs is included. A.R.H.

N78-17975*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HIGH RESOLUTION INFRARED SPECTROSCOPY: SOME NEW APPROACHES AND APPLICATIONS TO PLANETARY ATMOSPHERES
Michael J. Mumma Jan. 1978 57 p refs Presented at the NATO Advan. Study Inst. on Vibrational Intensities in Infrared and Raman Spectry., Belgirate, Italy, 1-10 Sept. 1977
(NASA-TM-78065) Avail: NTIS HC A04/MF A01 CSCL 03B

The principles of spectral line formation and of techniques for retrieval of atmospheric temperature and constituent profiles are discussed. Applications to the atmospheres of Earth, Mars, Venus, and Jupiter are illustrated by results obtained with Fourier transform and infrared heterodyne spectrometers at resolving powers (lambda/delta hyperon lambda of approximately 10,000 and approximately 10 to the seventh power), respectively, showing the high complementarity of spectroscopy at these two widely different resolving powers. The principles of heterodyne spectroscopy are presented and its applications to atmospheric probing and to laboratory spectroscopy are discussed. Direct absorption spectroscopy with tuneable semiconductor lasers is discussed in terms of precision frequency-and line strength-measurements, showing substantial advances in laboratory infrared spectroscopy. Author

N78-17976*# Cornell Univ., Ithaca, N. Y. Center for Radiophysics and Space Research.
HIGH RESOLUTION 10 MU SPECTROMETRY AT DIFFERENT PLANETARY LATITUDES. A PRACTICAL HADAMARD TRANSFORM SPECTROMETER FOR ASTRONOMICAL APPLICATION Final Report, 1 Sep. 1973 - 28 Apr. 1977. Ph.D. Thesis
Ming-Hing Tai, Martin Harwit, Gary Melnick, Frank W. Dain, Gerald Stasavage, Daniel A. Briotta, Jr., Leon W. King, and Marayana Kameth 28 Apr. 1977 226 p refs
(Grant NGR-33-101-210)
(NASA-CR-155736; CRSR-686; CRSR-655) Avail: NTIS HC A11/MF A01 CSCL 03B

Infrared observations at different latitudes were studied in order to obtain spectra in the 10 micrometers region to understand differences in chemical composition or physical structure of the optical features. In order to receive such spectra of a rotating planet, simultaneous observations at different latitudes were made. A Hadamard transform spectrometer with 15 entrance slits was used to obtain 15 simultaneous spectra, at a resolution of 0.01 micrometers. The spectral band covered contained 255 spectral elements. Author

N78-17977*# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
INTERNAL FRICTION Q FACTOR MEASUREMENTS IN LUNAR ROCKS Annual Report, 1 Jan. - 31 Dec. 1977
B. R. Tittmann Jan. 1978 6 p refs
(Contract NAS9-13846)
(NASA-CR-151630; SC577.51AR; AR-4) Avail: NTIS HC A02/MF A01 CSCL 03B

In order to better interpret recently reported values for the variation of seismic Q as a function of depth below the lunar surface, we have developed apparatus and made laboratory measurements of Q as a function of hydrostatic pressure, temperature and frequency. Our measurements of the Q associated with shear deformations have demonstrated that the large difference in Q between well outgassed and volatile rich rocks persists to pressures corresponding to a depth of at least 50 km. Here we report new measurements of Q as a function of temperature, on the development of techniques to measure the Q associated with extensional deformations under hydrostatic pressure, on the derivation of theoretical relations between our laboratory Q values and the attenuation coefficient of seismic waves, and on the development of a model for mechanism of adsorption. Author

N78-17978*# Lamont-Doherty Geological Observatory, Palisades, N. Y.
LUNAR HEAT-FLOW EXPERIMENT Final Technical Report, 6 Jun. 1966 - 30 Jun. 1975
M. G. Langseth Sep. 1977 290 p refs
(Contract NAS9-6037)
(NASA-CR-151619; CU-4-77) Avail: NTIS HC A13/MF A01 CSCL 03B

The principal components of the experiment were probes, each with twelve thermometers of exceptional accuracy and stability, that recorded temperature variations at the surface and in the regolith down to 2.5 m. The Apollo 15 experiment and the Apollo 17 probes recorded lunar surface and subsurface temperatures. These data provided a unique and valuable history of the interaction of solar energy with lunar surface and the effects of heat flowing from the deep interior out through the surface of the moon. The interpretation of these data resulted in a clearer definition of the thermal and mechanical properties of the upper two meters of lunar regolith, direct measurements of the gradient in mean temperature due to heat flow from the interior and a determination of the heat flow at the Apollo 15 and Apollo 17 sites. Author

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N78-17979 Maryland Univ., College Park.
THE 6 CENTIMETER WAVELENGTH OBSERVATIONS OF SOLAR ACTIVE REGIONS AND BURSTS WITH 6 ARC-SECONDS RESOLUTION Ph.D. Thesis
Constantine Emmanuel Alissandrakis 1977 190 p
Avail: Univ. Microfilms Order No. 77-27985

The Westerbork Synthesis Radio Telescope (WSRT) in the Netherlands was used for Solar observations at 6 cm on May 8-10, 1974. The WSRT was used for two-dimensional mapping of Solar active regions and for one-dimensional mapping of transient burst sources. Synthesis maps of four active regions were produced. Compact sources associated both with sunspots and with plage regions were detected. The compact plage sources were associated with areas of enhanced longitudinal magnetic field or with regions near the neutral line of the photospheric field. The magnetic field in the transition zone or low corona above the sunspots was calculated as 600-900 Gauss. This value is approximately two times larger than the predictions of current-free calculation of the magnetic field based on the Meudon magnetogram. Dissert. Abstr.

N78-17980 Maryland Univ., College Park.
STUDIES ON SOLAR HARD X-RAYS AND GAMMA-RAYS: COMPTON BACKSCATTER, ANISOTROPY, POLARIZATION, AND EVIDENCE FOR TWO PHASES OF ACCELERATION Ph.D. Thesis
Taeii Bai 1977 161 p
Avail: Univ. Microfilms Order No. 77-27986

Hard X-rays incident upon the photosphere with energies > or approximately 15 keV had probabilities of backscatter due to Compton collisions with electrons. This effect had a strong influence on the spectrum, intensity and polarization of solar hard X rays, especially for anisotropic models in which the primary X-rays were emitted predominantly toward the photosphere. The degree of polarization of the sum of the primary and reflected X rays with energies between about 15 and 30 keV was very large for anisotropic primary X ray sources, whereas it was less than about 4% for isotropic sources. The characteristics of the brightness distribution of the X ray albedo patch created by the Compton backscatter are discussed. A detailed calculation of bremsstrahlung production for a variety of electron spectra extending from the nonrelativistic region to relativistic energies was provided. Dissert. Abstr.

N78-17981 Iowa Univ., Iowa City.
STRUCTURE AND EVOLUTION OF SOLAR RADIO BURSTS AT 26.4 MHz Ph.D. Thesis
Henry Sha-lin Chen 1977 195 p
Avail: Univ. Microfilms Order No. 77-28437

Estimates of the evolution of two dimensional source brightness distributions at 26.4 MHz for solar bursts of spectral type II, III, IV and V are derived from observations. Thirty-two individual solar bursts were analyzed. A double Gaussian source brightness model was found to give a better fit to the visibility

data. A model assuming a large intrinsic emitting region without scattering effects is shown to be more consistent with the observations. It was found that the type V burst brightness distribution can be explained as an isotropic point source emitting at second harmonic level. Several type V bursts exhibited a loop type motion suggestive of the source region motion constrained to move on closed field lines. The possibility of a common shock front origin for the type II, IV event is discussed. Dissert. Abstr.

N78-17982*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NONLINEAR STABILITY OF SOLAR TYPE 3 RADIO BURSTS. 1: THEORY
Robert A. Smith (Observatoire de Paris-Meudon (France)), M. L. Goldstein, and K. Papadopoulos (nrl, Washington, D. C.) Jan. 1978 53 p refs Submitted for publication
(NASA-TM-78079) Avail: NTIS HC A04/MF A01 CSCL 03B

A theory of the excitation of solar type 3 bursts is presented. Electrons initially unstable to the linear bump-in-tail instability are shown to rapidly amplify Langmuir waves to energy densities characteristic of strong turbulence. The three-dimensional equations which describe the strong coupling (wave-wave) interactions are derived. For parameters characteristic of the interplanetary medium the equations reduce to one dimension. In this case, the oscillating two stream instability (OTSI) is the dominant nonlinear instability, and is stabilized through the production of nonlinear ion density fluctuations that efficiently scatter Langmuir waves out of resonance with the electron beam. An analytical model of the electron distribution function is also developed which is used to estimate the total energy losses suffered by the electron beam as it propagates from the solar corona to 1 A.U. and beyond. Author

N78-17983# Royal Aircraft Establishment, Farnborough (England).
THE USE OF NTC THERMISTORS FOR MEASUREMENT OF THE SUN'S RADIATION AND OF WIND SPEED
Jun. 1977 26 p refs Transl. into ENGLISH from Anwendung von NTC-Widerstaenden zur Messung der Sonnenstrahlung und zur Messung von Windgeschwindigkeiten (Hamburg), West German Report 26 p
(RAE-Lib-Trans-1916; BR60395) Avail: NTIS HC A03/MF A01

The design of a low power, robust, pyrheliometer for field use, employing NTC thermistors and the design of a thermistor wind speed measuring device also for field use are described. Both give direct indication on moving coil instruments or can be used with a recorder. Author

N78-17984# California Inst. of Tech., Pasadena.
COOPERATIVE STUDIES OF SOLAR ACTIVITY AND CHROMOSPHERIC STRUCTURE Final Report, 1 Oct. 1975 - 30 Oct. 1976
Harold Zirin 7 Dec. 1976 16 p refs
(Contract F19628-76-C-0055)
(AD-A045590; AFGL-TR-77-0105) Avail: NTIS HC A02/MF A01 CSCL 03/2

Observations were carried out and analyzed on the physics of solar flares, active phenomena in quiet regions: such as ephemeral active regions, macrospicules and spicules, and Coronal holes and the chromosphere under coronal holes. Author (GRA)

N78-17985# Rochester Univ., N. Y. Dept. of Mechanical and Aerospace Sciences.
SOLAR MAGNETO-ATMOSPHERIC WAVES AND PENUMBRAL WAVES Final Report, Sep. 1974 - 30 Sep. 1976
John H. Thomas, Alan H. Nye, and Alfred Clark, Jr. 22 Dec. 1976 52 p
(Contract F19628-75-C-0011)
(AD-A046276; AFGL-TR-77-0017) Avail: NTIS HC A04/MF A01 CSCL 03/2

The linearized theory of magneto-atmospheric waves (involving the combined restoring forces due to buoyancy, compressibility, and magnetic field) is developed for the case of a horizontal magnetic field which may vary with height. The convective stability of the basic atmosphere is considered, and it is shown that a nonuniform horizontal magnetic field may be destabilizing as well as stabilizing. It is found that penumbral waves may be identified with magneto-atmospheric waves of the plus type that are vertically trapped at photospheric levels. Although most of the wave energy is contained in the penumbral photosphere and subphotosphere, the maximum vertical velocity occurs in the chromosphere where the waves are evanescent (and where they are observed in H alpha). An exact analytical solution for magneto-atmospheric wave modes is found in the case of an isothermal atmosphere permeated by a uniform horizontal magnetic field, without making the usual short-wavelength approximation. The exact solution mentioned above is also used in conjunction with a simple two-layer model of a sunspot penumbra to further study the mode of running penumbral waves. The lowest plus eigenmode of the model is in good agreement with observations of penumbral waves. GRA

N78-17986# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NO. 396, AUGUST 1977. PART 1: PROMPT REPORTS, DATA FOR JULY 1977 - JUNE 1977
Helen E. Coffey Aug. 1977 122 p
(PB-273617/1; SGD-396-Pt-1) Avail: NTIS HC A06/MF A01 CSCL 03B

This prompt report provides data for July 1977 on: alert periods, daily solar indices, solar flares, solar radio waves, solar X-ray radiation, coronal holes, spacecraft observations, solar wind measurements inferred IP Magnetic field polarities, and mean solar magnetic field. It also provides data for June 1977 on: daily solar activity centers, sudden ionospheric disturbances, solar radio waves, cosmic rays, geomagnetic indices and radio propagation indices. GRA

N78-17987# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NO. 396, AUGUST 1977. PART 2: COMPREHENSIVE REPORTS, DATA FOR FEBRUARY 1977 - JANUARY 1977 AND MISCELLANEA
Helen E. Coffey Aug. 1977 48 p
(PB-273618/9; SGD-396-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 03B

Tables and charts presented contain data on: active regions, synoptic solar maps, solar flares, solar radio waves, energetic solar particles and plasma, synoptic chart, abbreviated calendar record, regional flare index, solar radio waves for May 1977, and cosmic rays for April 1977. GRA

N78-17988# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
MARS SATELLITE DEIMOS INTERACTION WITH THE SOLAR WIND AND ITS INFLUENCE ON FLOW AROUND MARS
A. V. Bogdanov 1977 39 p refs
(PR-339) Avail: NTIS HC A03/MF A01

Data are given indicating a possible solar wind Mars satellite Deimos strong interaction. The plasma measurements onboard Soviet interplanetary probe Mars-5 showed the drop of ion density and disturbance of the ion energy spectra in the region behind Deimos at a distance of about 20,000 km. The dimension of Deimos is lower than the ion giroradius and the observed effect may exist in the case of a strong magnetic field intrinsic to Deimos or within the Deimos gas envelope. Some ion spectra characteristics indicate that the second possibility is more probable. The existence of solar wind strong interaction with Deimos can have an influence on the Martian magnetosphere and bow shock. The dimension of magnetosphere is maximal when Mars is shaded by Deimos. Author (ESA)

N78-17094*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ARTIFICIAL SOLAR ECLIPSE: EXPERIMENT MA-148
G. M. Nikolskiy (USSR Academy of Sci.), A. I. Simonov (USSR Academy of Sci.), I. S. Kim (USSR Academy of Sci.), R. T. Guila, M. D. Jenness, and A. N. Lunde *In its* Apollo-Soyuz Test Proj., Vol. 1 1977 p 85-99 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 03B

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N78-17091*# Naval Research Lab., Washington, D. C.
SOFT X-RAY OBSERVATIONS: EXPERIMENT MA-048
S. Shulman, S. Naranan, W. Snyder (Johns Hopkins Univ.), D. Yentis, R. Cruddace, H. Friedman, G. Fritz, and R. Henry (Johns Hopkins Univ.) *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 39-48 refs (For availability see N78-17088 08-12)
Avail: NTIS HC A24/MF A01 CSCL 03B

N78-17092*# California Univ., Berkeley.
EXTREME ULTRAVIOLET SURVEY: EXPERIMENT MA-083
S. Bowyer, B. Margon, M. Lampton, F. Paresce, and R. Stern *In* NASA. Johnson Space Center Apollo-Soyuz Test Proj., Vol. 1 1977 p 49-70 refs (For availability see N78-17088 08-12)
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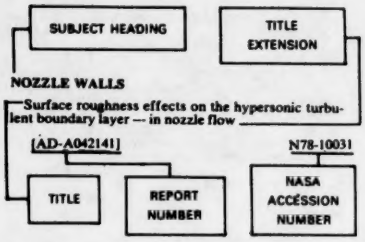

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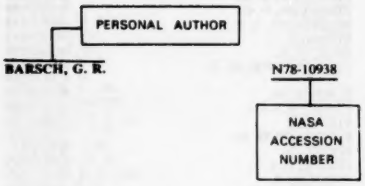

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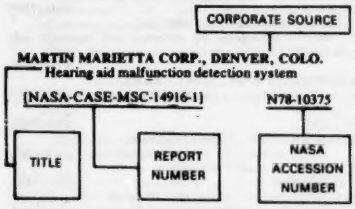

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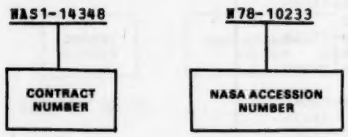

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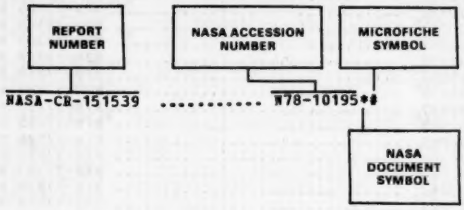

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NASA-CR-155548 ..... N78-17427*#
NASA-CR-155549 ..... N78-17428*#
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NASA-CR-155551 ..... N78-17430*#
NASA-CR-155552 ..... N78-17431*#
NASA-CR-155559 ..... N78-17432*#
NASA-CR-155565 ..... N78-17050*#
NASA-CR-155566 ..... N78-17051*#
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NASA-CR-155609 ..... N78-17441*#
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NASA-CR-155734 ..... N78-17157*#
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NASA-CR-155736 ..... N78-17976*#
NASA-CR-155737 ..... N78-17956*#
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NASA-CR-155922 ..... N78-17844*#
NASA-CR-155923 ..... N78-17158*#
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NASA-CR-155928 ..... N78-17725*#
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NASA-CR-156685 ..... N78-17533*#
NASA-CR-156688 ..... N78-17640*#
NASA-CR-156839 ..... N78-17915*#

NASA-EP-149 ..... N78-17476*#

NASA-HF-87/10-77 ..... N78-17123*+

NASA-RP-1014 ..... N78-17151*#

NASA-SP-273 ..... N78-17724*#
NASA-SP-412 ..... N78-17088*#
NASA-SP-7011 (177) ..... N78-17655*+
NASA-SP-7037 (90) ..... N78-16986*+
NASA-SP-7041 (14) ..... N78-17424*+

NASA-TM-X-74038 ..... N78-17057*#

NASA-TM-73652 ..... N78-17041*#
NASA-TM-73750 ..... N78-17558*#
NASA-TM-73757 ..... N78-17942*#
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NASA-TM-73761 ..... N78-17940*#
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NASA-TM-73789 ..... N78-17187*#
NASA-TM-73792 ..... N78-17152*#
NASA-TM-73813 ..... N78-17397*#
NASA-TM-73820 ..... N78-17486*#
NASA-TM-73821 ..... N78-17001*#
NASA-TM-73822 ..... N78-17172*#
NASA-TM-73826 ..... N78-17153*#
NASA-TM-73835 ..... N78-17466*#
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NASA-TM-73861 ..... N78-17467*#
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NASA-TM-73882 ..... N78-17154*#
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NRL-MR-3588 ..... N78-17199 #
NRL-MR-3590 ..... N78-17543 #
NRL-MR-3593 ..... N78-17885 #
NRL-MR-3597 ..... N78-17538 #
NRL-MR-3601 ..... N78-17644 #
NRL-MR-3623 ..... N78-17731 #
NRL-MR-3628 ..... N78-17351 #
NRL-MR-3645 ..... N78-17830 #
NRL-MR-3648 ..... N78-17884 #
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ONR-CR212-225-3 ..... N78-17028 #

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OWRT-A-048-NJ(2) ..... N78-17945 #

OWRT-B-092-ILL(4) ..... N78-17491 #

OWRT-C-6106(5213)(2) ..... N78-17458 #

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PB-273098/4 ..... N78-17490 #
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PB-273725/2 ..... N78-17704 #
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RADC-TR-77-263-VOL-1 ..... N78-17267 #
RADC-TR-77-299 ..... N78-17085 #
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